Final Report

LIMITED ENERGY STUDY, POWER DISTRIBUTION

FORT GREELY, ALASKA

Prepared for

U.S. ARMY ENGINEER DISTRICT, MOBILE
MOBILE, ALABAMA 36628

Under

U.S. ARMY ENGINEER DISTRICT, MOBILE
INDEFINITE DELIVERY A-E CONTRACT
Contract No. DACA01-94-D-0033
Delivery Order 003
EMC No. 1406-003

March 1996

By

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LIST OF ABBREVIATIONS

A	-	ampere
ACSR	-	aluminum conductor steel reinforced
ANSI	-	American National Standards Institute
ASCE	-	American Society of Civil Engineers
ASME	-	American Society of Mechanical Engineers
AWG	-	American Wire Gauge
BIL	-	basic insulation level
CNW	-	condenser water
CNWP	-	condenser water pump
CNWR	-	condenser water return
CNWS	-	condenser water supply
COE	-	Corps of Engineers
CRTA	-	Cold Regions Test Activity
CT	-	current transformer
Δ	-	(Delta) Greek letter notation for electrical equipment connected in a "delta" configuration
ECIP	-	Energy Conservation Investment Program
ECO	-	Energy Conservation Opportunity
EMC	-	E M C Engineers, Inc.
EPR	-	Ethylene Propylene Rubber
EPRI	-	Electric Power Research Institute
F	-	Fahrenheit
FEMP	-	Federal Energy Management Program
ft	-	foot, feet
gal	-	gallons
GL	-	ground line
gpm	-	gallons per minute
hp	-	horsepower
hr	-	hour
IEEE	-	Institute of Electrical and Electronic Engineers
IL	-	in-line
kA	-	one thousand ampere
kV	-	one thousand volts
kW	-	kilowatt, one thousand watts
kWh	-	kilowatt-hours, one thousand watt-hours
LCCA	-	life cycle cost analysis
LF	-	load factor
lb/hr	-	pounds per hour
MCACES	-	Mechanical Cost Accounting Computer Estimating System
MW	-	megawatt, one-thousand kilowatts
NBS	-	National Bureau of Standards
NEC	-	National Electric Code
NESC	-	National Electrical Safety Code
NIST	-	National Institute of Standards and Technology

OA/FA	-	liquid-immersed, self-cooled/forced-air-cooled
OH	-	overhead
O&M	-	operation and maintenance
P	-	perpendicular
PF	-	power factor
ϕ	-	(Phi) Greek letter notation for "phase"
ϕ-N	-	shorthand notation for a phase-to-neutral wire connection
ϕ-ϕ	-	shorthand notation for a phase-to-phase wire connection
psia	-	pounds per square inch absolute
psig	-	pounds per square inch gage
rpm	-	revolutions per minute
sec	-	second
SIR	-	Savings-to-Investment Ratio
SOW	-	scope of work
sq ft	-	square foot
temp.	-	temperature
UG	-	underground
V	-	volt(s)
VAR	-	volts-ampere reactive
XLPE	-	Cross-Linked Polyethylene
Y	-	short hand notation for electrical equipment connected in an "ungrounded wye" configuration
YGRD	-	short hand notation for electrical equipment connected in a "grounded wye" configuration
yr	-	year(s)

at this site. At the very least, ground fault detection should be implemented as determined in previous studies.

1. INTRODUCTION

1.1 AUTHORITY FOR STUDY

This study was performed and this report prepared under Contract No. DACA01-94-D-0033, Delivery Order No. 003. The Delivery Order was issued by U.S. Army Engineer District, Mobile, to E M C Engineers, Inc. on 28 September 1994.

1.2 PURPOSE OF STUDY

The purpose of this study is to evaluate the Energy Conservation Opportunity (ECO) associated with converting the existing Ft. Greely power distribution system from a 2400 volt, 3-wire, ungrounded delta distribution system to a 4160 volt, 4-wire, grounded wye distribution system.

1.3 SCOPE OF WORK

The Scope of Work (SOW) for this energy study is included in Appendix A of this report. The following services are required by the SOW:

- Perform a limited site survey of the overhead and underground distribution system, the central plant, and other facilities was performed to determine the parameters of the existing system and evaluate its physical condition. The evaluation of the systems physical condition includes insulators, crossarms, poles, wires, connectors and transformers.

- Perform computer modeling of the distribution system to determine the system losses associated with operating at 2400 volts and 4160 volts for both the pre-realignment (before 1997) and post-realignment (after 2001) scenarios.

- Determine the construction costs associated with converting the distribution system from a 2400 volt, 3-wire, ungrounded delta to a 4160 volt, 4-wire, grounded wye.

- Determine the cost of providing electrical service to post-realignment buildings directly from the Golden Valley Electric Association (GVEA) distribution system. [EMC was instructed not to address this issue.]

- Perform life cycle cost analysis (LCCA) according to Energy Conservation Investment Program (ECIP) and Federal Energy Management Program (FEMP) criteria.

- Provide a comprehensive report presenting field survey data, methods of analysis and recommendations of the study.

- Prepare ECIP/FEMP programming documentation for ECOs which meet government funding criteria.

1.4 DEMAND AND ENERGY COSTS

The demand and energy costs for electricity delivered to Fort Greely from GVEA and Fort Wainwright were taken from data provided by Fort Wainwright personnel. Approximately 83% of the electric energy used at Fort Greely is derived from Fort Wainwright generators and wheeled over GVEA distribution lines for the cost of wheeling. The remaining 17% is purchased directly from GVEA at a cost based on their GS-2 rate schedule. Demand charges are based on the peak kW used per month, regardless of whether it is wheeled or purchased power. In order to simplify the analysis for this study, the energy costs were evaluated over the one year period starting on the first day of September 1993 and ending on the last day of August 1994. The energy costs from the two different suppliers, Fort Wainwright and GVEA, were weighed based upon the percentage used from each source at Fort Greely and summed to obtain an average energy cost. The demand charge remains the same in either case. The electric rates used in this study are as follows:

- Electric demand charge: $6.25/kW/month
- Electric energy charge: $0.0711 per kWh

If the demand charge is incorporated into the energy charge to further simplify the calculations, the electric energy charge will be $0.832 per kWh.

1.5 CONSTRUCTION COST ESTIMATING

ECO construction costs were taken primarily from the MCACES construction cost estimating database for Fairbanks (1994). When the cost information in this database was inadequate, vendor quotes or the 1995 Means Electrical Cost Data were used. An additional 20% location factor was added to all costs that were not taken from the MCACES database to account for added shipping expenses and other charges associated with Fort Greely's remote location and/or extreme weather. Additional markups used for the LCCA include:

- 15% for contractor's overhead.
- 10% for contractor's profit.
- 3% for contractor's bond.
- 20% for contingency.

- 4% for escalation.
- 5% for SIOH.
- 6% for design costs.

1.6 LIFE CYCLE COST ANALYSIS METHODOLOGY

The Life Cycle Cost Analysis (LCCA) methodology used in this study is a Present Worth analysis. It compares the present worth of the energy cost savings associated with the distribution system improvements over a 20 year period (reflected back into the first year of the period) with the construction cost or investment necessary to implement the distribution system improvements in the first year of the period. The Savings-to-Investment Ratio (SIR) must be greater than 1.25 in order to qualify under the ECIP Program. Thus, the energy cost savings over a 20 year period must be 25% greater than the investment required in the first year. Operation and maintenance (O&M) costs were neglected because there is no significant difference in O&M between 2400 volts and 4160 volts.

Economic analyses were performed in accordance with the January 1994 ECIP guide. Uniform Present Value (UPV) factors are based on a 4.1 percent DOE discount rate (for FEMP projects). The UPV factors were taken from Table A-2 and Ba-4 of the NISTIR 85-3273-10 (Rev. 10/95), Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis 1996, (the current annual supplement to the NIST Handbook 135 and NBS Special Publication 709). The economic and service life of equipment was taken from Appendix B of the ECIP guide. Copies of all the appropriate LCCA factors are found in Appendix J.

The following UPV factors, adjusted for average fuel price escalation, were taken from the NIST 135 Supplement for Industrial Customers.

Life (Years)	Electricity	Natural Gas	Non-Energy
20	14.47	17.32	13.47

1.7 ORGANIZATION OF DOCUMENT

This report is organized as follows:

- Section 2 describes the existing electrical distribution system and the field tests performed to evaluate its physical condition.

- Section 3 discusses in detail the system model and load flow analysis used to determine the system losses for the existing electrical distribution system.

- Section 4 describes the electrical distribution system after realignment has reduced the number of facilities served.

- Section 5 discusses in detail the system model and load flow analysis used to determine the system losses for the reduced electrical distribution system.

- Section 6 summarizes the results of Sections 2 through 5 and recommends a course of action.

2. EXISTING SYSTEM DESCRIPTION AND EVALUATION (1995 TO 1997)

2.1 GENERAL

The existing electric distribution system at Ft. Greely is operated as a 2400 volt (V), 3-phase (ϕ), ungrounded, delta (Δ) system on all feeders except one. Feeder 9 is more than three times the length of the other eight feeders combined, and is operated as a 7200 V, 3ϕ, ungrounded, Δ system. It feeds the remote facility at Bolio Lake and all of the Ranges.

2.2 DETAILS

Major features of each electric distribution system are described in detail below.

2.2.1 <u>Buildings</u>

There are currently 231 buildings that receive electric power from the Fort Greely electric distribution system. The buildings total 1,699,787 sq ft consisting of schools, offices, housing units, aircraft hangars, fuel stations, construction shops, water and waste treatment facilities, and a power and heating plant. The majority of buildings are located in the cantonment area and the rest are located at the Cold Regions Test Activity (CRTA) at Bolio Lake, and at the Ranges (Arkansas, Beales, Colorado, Georgia, Lampkin, Mississippi, Tennessee and Texas). Generally, the building loads are of high power factor (approximately 95%) and high load factor (approximately 80%). Approximately 81% of the building loads are 3ϕ, the primary building utilization voltage is 120/208 V, 3ϕ, grounded wye.

2.2.2 <u>Transformers</u>

The buildings are supplied by a total of 298 transformers from the Fort Greely electric distribution system. Only 288 transformers actually supply building loads, six are step-up substation transformers on Feeder No 9, and four are station service transformers for Building 606, the Power & Heating Plant. The step-up substation transformers are arranged into two 3ϕ, banks. The following describes these transformers in more detail.

2.2.2.1 Main Transformer (GVEA)

The main transformer supplies the base from the GVEA distribution system. It is a 2500/3125 kVA, OA/FA, 24.9/14.4 - 2.4 kV, YGRD-Δ substation class transformer with top mounted primary and secondary bushings. This transformer is located adjacent to Building 606 and is owned and maintained by GVEA. It is not included as part of the 298 transformers described above.

This transformer will need to be replaced if the Fort Greely electric distribution system is upgraded to 4.16 kV. It will be necessary to coordinate with GVEA on the exact winding configuration.

2.2.2.2 Feeder 9 Step-Up Substation Transformer

The Feeder 9 substation consists of three 1ϕ, 500 kVA, OA, 2.4/4.16 - 7.2/12.47 kV pole-mounting type transformers, connected Δ-Δ, with top mounted primary and secondary bushings. The transformers are mounted on a concrete pad adjacent to Building 606.

These transformers can be rewired as a grounded wye (YGRD) on both the primary and secondary and reused if the system voltage is increased to 4.16 kV. This will increase the Feeder 9 voltage from 7200 V to 12,470 V.

2.2.2.3 Richardson Step-Up Substation Transformer

The Richardson substation consists of three 1ϕ, 200 kVA, OA, 2.4 - 7.2 kV pole-mounting type transformers, connected Δ-Δ, with top mounted primary and secondary bushings. The transformers are mounted on a concrete pad near the Richardson Highway in the West Post area.

The nameplate on the transformers does not specifically indicate that the transformers are rated for operation at 4.16 kV and 12.47 kV. However, EMC believes that these transformers can be rewired as a grounded wye (YGRD) on both the primary and secondary, and reused at 4.16 kV and 12.47 kV, respectively. The winding voltage and insulator bushing ratings will not change and the phase-to-phase clearance is adequate. It will be necessary to rewire these transformers to match the Feeder 9 step-up transformer voltage.

2.2.2.4 Building 606 Station Service Transformers

Building 606 is supplied by four station service transformers: SS-1, SS-2, and two SM1As. Transformer SS-1 is a 300 kVA dry type transformer. Transformer SS-2 is a 300 kVA pad mounted transformer. Both SM1A transformers are 500 kVA dry type transformers. All

four transformers are 3ϕ, 2400-480 V, Δ-Δ. They will all need to be replaced if the system voltage is upgraded to 4.16 kV, because they cannot be rewired.

2.2.2.5 Load Transformers

Five of the 288 load supplying transformers are 3ϕ pad-mounted transformers, 207 are connected into sixty-nine 3ϕ transformer banks, and the remaining 76 are 1ϕ transformer banks. The transformer voltages, connections, and quantities are shown in Table 2-1 below.

Table 2-1. Load Transformer Connections

	Voltage				Mount	No. of	Trans./	No. of
ϕ	Primary	Conn.	Secondary	Conn.	Type	Banks	Bank	Trans.
3	2400	Δ	120/208	YGRD	Pole	50	3	150
3	2400	Δ	277/480	YGRD	Pole	6	3	18
3	7200	Δ	120/208	YGRD	Pole	13	3	39
3	2400	Δ	120/208	YGRD	Pad	3	1	3
3	7200	Δ	120/208	YGRD	Pad	2	1	2
1	2400	ϕ-ϕ	120/240	Ctr. Tap	Pole	56	1	56
1	7200	ϕ-ϕ	120/240	Ctr. Tap	Pole	20	1	20
Totals						**150**		**288**

All of the pad-mounted transformers will need to be replaced if the distribution system voltage is increased to 4.16 kV and 12.47 kV. The 3ϕ, pole-mounted transformer primaries can be rewired to a grounded wye configuration and reused. The 1ϕ, pole mounted transformers can be rewired from ϕ-ϕ to ϕ-N and reused. The winding voltage and insulator bushing ratings will not change.

2.2.3 Feeders

The load transformers are supplied by nine feeders comprised of 31.2 miles of overhead (OH) lines and 10.7 miles of underground (UG) lines. The electric distribution system is operated as an ungrounded delta at 2400 volts, 3ϕ. Table 2-2 below shows the feeder characteristics.

Table 2-2. Feeder Description

Feeder No.	Length & Size				Voltage L-L	Connected kVA	
	OH (ft)	AWG	UG (ft)	AWG		3 ϕ	1 ϕ
1	6250	4/0	0	-	2400	645	580
2	1750	4/0	0	-	2400	1320	0
3	3000	4/0	0	-	2400	1035.5	45
4	1700	4/0	0	-	2400	1637.5	0
5	16950	4/0	2400	2	2400	1815	115
6	0	Bus	0	-	2400	0	0
7	9450	4/0	0	-	2400	1357.5	212.5
8	4000	4/0	2000	4/0	2400	15	992.5
9	122060	2	52,096	2	7200	1557.5	260.5
Totals	**165,160**		**56,496**			**9383**	**2205.5**

Approximately 81% of the connected load for the base is three phase. Line maintenance personnel indicated that the single phase loads are well balanced between phases. In general, the feeders supply the following loads and locations:

- Feeder No. 1 - Housing in the main base area.
- Feeder No. 2 - Offices and shops in the main base area.
- Feeder No. 3 - Offices and shops in the main base area.
- Feeder No. 4 - Offices and shops in the main base area.
- Feeder No. 5 - Old and middle post areas; Allen Air Field.
- Feeder No. 6 - Overhead tie.
- Feeder No. 7 - Sewage plant and east base area.
- Feeder No. 8 - Housing in the main base area.
- Feeder No. 9 - Remote sites; Bolio Lakes and the Ranges.

2.2.3.1 Overhead Feeder Construction

Approximately 74% of the electric distribution system, by feeder length, is overhead construction. The original overhead electric distribution system was constructed between 1948 and 1957. The oldest part of the system consists of the old post and middle post at the north end of the base near Allen Air Field. The next oldest line construction was done in the mid-1970s, and the newest line construction was done in the mid-1980s.

The overhead electric distribution system is almost exclusively wooden poles and crossarms. The poles are all 40 to 50 ft in height, Class 2 or 3, and spaced at 100 to 150-ft intervals. The majority of poles are cedar, although some Douglas Fir are used. The treatment method varies from pentachlorophenol (reddish color), to chromated copper arsenate or CCA (greenish color), to creosote oil. Most poles are fully treated, however, some of the older poles are butt treated only. Eight-foot crossarms are standard although

some narrow profile Epoxirods™ have recently been installed. The Epoxirods™ comprise a very small percentage of the crossarms in use, however.

Generally, the lines are mounted on pin insulators on an 8-ft crossarm, in a flat, parallel configuration. Two lines are located on one side of the pole and one line is located on the other side. Ridge pins are typically not used, except on some of the Epoxirod™ installations. There is space available on the crossarms to install a new neutral conductor if the distribution system is converted to a grounded wye. Where the crossarms have been modified from typical construction or Epoxirods™ are used, a new neutral can be installed approximately 40 inches below the crossarm on the pole.

The majority of the base load is supplied by the overhead electric distribution system. The feeders in the high density load areas of the cantonment are #4/0 AWG, ACSR. Conductors in all other areas are #2 AWG, ACSR. Line maintenance personnel have standardized on these two conductor sizes as well as ACSR for overhead lines, although some #2 AWG CU and # 4AWG CU lines still exist in older parts of the system. None of the phase conductors will have to be replaced if the system voltage is upgraded to 4.16 kV and 12.47 kV. The load current will actually be decreased at the higher voltages.

The majority of the 2.4 kV pin insulators have been replaced with 15 kV class insulators over the past ten years. Approximately 15% of these will need have to be replaced. Refer to the Field Investigations below for further discussion on the pin insulators.

2.2.3.2 Underground Feeder Construction

The remaining 26% of the electric distribution system is underground construction. Most of the underground electric distribution system was installed in the mid-1980s using 15 kV, shielded, EPR insulated cable. It was assumed that the insulation level is 133% minimum, since the system is ungrounded with no ground fault indication. Additionally, most of the underground cable was direct buried. In some cases, such as the underground feeder to "the Condos", it was not buried deep enough to avoid the effect of frost heave. In those cases, the cable has been heaved to the surface and damaged resulting in cable splices in several places.

Line maintenance personnel have standardized on 15 kV, shielded, EPR insulation for underground distribution lines and risers, however, some 15 kV, XLPE insulated cable still exists in older parts of the base.

It is not necessary to replace the feeders or add an additional wire for a neutral if the system voltage is upgraded to 4.16 kV and 12.47 kV. All three-phase feeders supply balanced three-phase loads. No single-phase loads were supplied by underground feeders.

2.2.4 Generators

There are five diesel engine generators located in Building 606. Generators 1, 2, and 3 are alike and generators 4 and 5 are alike. Table 2-3 below summarizes the generators characteristics.

Table 2-3. Characteristics of Engine Generators

Gen. No.	Rated kVA	PF	Rated kW	rpm	ϕ	Voltage	Mfr.	Ser. No.	Output Connect.
1	1250	0.8	1000	360	3	2400	Elliott Co.	3-S-9691	Y
2	1250	0.8	1000	360	3	2400	Elliott Co.	2-S-9691	Y
3	1250	0.8	1000	360	3	2400	Elliott Co.	1-S-9691	Y
4	1563	0.8	1250	360	3	2400/4160	Elliott Co.	4-S-10915	Δ
5	1563	0.8	1250	360	3	2400/4160	Elliott Co.	7-S-10915	Δ

The generators are usually operated as peak shavers to reduce the load on the GVEA main transformer. The base load can reach 3450 kW and the GVEA transformer is rated at 2500/3125, liquid-immersed, self-cooled/forced-air cooled (OA/FA). Based on the recorded data from July 1, 1994 through July 31, 1995, the generators are usually operated at approximately 1000 kW when the base load reaches 3400 kW.

All of the generators are 6-lead machines. Generators 1, 2, and 3 are connected in an ungrounded Y configuration, meaning that the T1, T2, and T3 leads are connected to phases A, B, and C respectively, and the T4, T5, and T6 leads are tied together at a common neutral bus not bonded to ground. This indicates that the windings are only rated for 1386 V and means that if these generators are to be used on a 4160 V, grounded wye system, they will require a 2.4 - 4.16 kV, Δ-YGRD step-up transformer.

Generators 4 and 5, on the other hand, are connected in a delta configuration, meaning that the T1 and T3 leads are tied together, the T2 and T4 leads are tied together, and the T3 and T5 leads are tied together. This indicates that the windings are rated for 2400 V and means that these generators can be used on a 4160 V, grounded wye system by reconnecting the leads from a delta configuration to a grounded wye configuration.

2.2.5 Medium Voltage Switchgear

The main switchgear at Building 606 is from two different manufacturers. The gray switchgear, north and south was manufactured by General Electric Company (GE). It is rated for 1200 A and 4.16 kV (4.76 kV maximum). The circuit breakers are GE Magna-blast™ type. The following data was taken from the nameplate of one breaker:

50 MVA - Interrupting Rating

7,000 A - Interrupting Rating @ Rated Voltage (4160 V)
12,500 A - Maximum Interrupting Rating
20,000 A - Momentary Rating
8 Cycles - Interrupting Time

The orange switchgear (commercial tie with GVEA) was manufactured by Westinghouse Electric Company (Westinghouse). It is rated for 1200 A and 4.16 kV (4.76 kV maximum). No interrupting ratings were listed on the equipment, and no documentation was found that confirmed its ratings. The breakers, however, were Westinghouse De-Ion™ type of the same approximate generation as the GE Magna-blast™ breakers. It was assumed for the purpose of this study that the interrupting and momentary ratings of the Westinghouse De-Ion™ breakers are the same as the GE Magna-blast™ breakers.

Table 2-4 below shows the fault levels available at the GE and Westinghouse busses based on the results of previous fault studies.

Table 2-4. Short Circuit Levels Available

Bus	Utility & 5 Generators (kA/MVA)	Utility Only (kA/MVA)	5 Generators Only (kA/MVA)	4 Generators Only (kA/MVA)
General Electric	14.3/60	5.3/22	10.1/42	7.9/33
Westinghouse	14.3/60	5.3/22	10.0/41.5	7.9.33

When the five base generators and the utility are on-line simultaneously (represented by the shaded area in the table above), the first half cycle fault levels available exceed the interrupting rating of the breakers. Two factors mitigate these findings, however. First, the breakers have an 8 cycle interrupting time, which means that by the time the breaker actually interrupts the fault, 4 to 8 cycles after its inception, the fault level has actually decreased significantly. Second, the occurrence of all five base generators and the utility operating simultaneously is rare. It is expected that the simultaneous operation of the all five generators and the utility would only occur for a short period of time in anticipation of a utility outage.

It will not be necessary to replace any of the switchgear if the system voltage is upgraded to 4.16 kV. The existing switchgear is rated for 4.16 kV and the bus ampacities will be more than adequate, since the load current will be reduced to 58% of its present value at the higher voltage. Additionally, the available fault currents will decrease with the increased voltage.

2.2.6 Miscellaneous Equipment

2.2.6.1 Richardson Step-Up Substation Breaker

The oil circuit breaker at this location is an Allis Chalmers Type OX-18 (Serial No. 305756). It is rated for 600 A continuous current, 7.2 kV and 75 kV BIL. It was manufactured in December 1955, and is only rated for 7.2 kV phase-to-phase. It will need to be replaced with a 15 kV phase-to-phase rated switch.

2.2.6.2 Load Break Air Switches

These sectionalizer switches are relatively new additions to the overhead distribution system and are A B Chance, Type D, Catalogue No. CD7HE1CL. They are rated for 600 A continuous current, 40 kA momentary current, 15 kV, and 110 kV BIL. These switches will not have to be replaced if the system voltage is increased to 4.16 and 12.47 kV.

2.2.6.3 Cutout Switches

Each load transformer is protected by an XS Style cutout switch. The rating of the cutouts is not known, however, they have only been available in a 15 kV rating for many years. In addition, a 200 A continuous current rating is commonly used on overhead distribution systems, especially in conjunction with 4/0 ACSR. Therefore, it is assumed that the cutouts are rated at 200 A continuous current, 15 kV, and 110 kV BIL, the standard rating available from most manufacturers. While the cutouts will not have to be replaced, their fuses will all have to be replaced if the voltage is upgraded to 4.16 kV and 12.47 kV. The National Electrical Code (NEC, Table 450-3(a)(1)) requires that the continuous current rating of the primary protection for a transformer not exceed 300% of the rated continuous primary current of the transformer. Since the primary current of the transformer will be reduced to 58% of its original value because of the voltage increase, all of the fuses will be too large.

2.2.6.4 Protective Relays

A Protective Device Coordination Study was recently performed and the protective devices reset to the recommended values. If the system voltage is increased, the load and fault current levels will all change. This will require that any current sensing type protective device be reset in order to maintain coordinated tripping and to ensure proper protection. Table 2-5 below shows the devices with current sensitive tripping that will need to be reset.

Table 2-5. Protective Devices with Current Sensing

Item No.	Bus	Equipment	Device Type	Quantity
1	Gray Switchgear South	Generator No. 1	51V	3
2	Gray Switchgear South	Generator No. 2	51V	3
3	Gray Switchgear South	Generator No. 3	51V	3
4	Gray Switchgear South	Feeder No. 1	50/51	3
5	Gray Switchgear South	Feeder No. 2	50/51	3
6	Gray Switchgear South	Feeder No. 3	50/51	3
7	Gray Switchgear South	Feeder No. 4	50/51	3
8	Gray Switchgear South	Feeder No. 5	50/51	3
9	Gray Switchgear South	Station Service No. 1	50/51	3
10	Gray Switchgear South	SM1A Tie	50/51	3
11	Gray Switchgear North	Generator No. 4	51V	3
12	Gray Switchgear North	Generator No. 5	51V	3
13	Orange Switchgear	GVEA Transformer	50/51	3
14	Orange Switchgear	GVEA Transformer	46	1
15	Orange Switchgear	Feeder No. 7	50/51	3
16	Orange Switchgear	Feeder No. 8	50/51	3
17	Orange Switchgear	Feeder No. 9	50/51	3
18	Orange Switchgear	Overhead Tie	50/51	3
19	Orange Switchgear	Station Service No. 2	50/51	3
Total				**55**

It is believed that the current transformers (CTs) will not have to be replaced with smaller ratio CTs. The range of tap settings available on the protective relays will allow them to be reset to the new current values.

With the system configuration changed to a grounded wye, and the Building 606 and Richardson substation step-up transformers rewired to grounded wye configurations on both the primary and secondary, the 7.2 kV system will have ground fault protection, which it presently does not have.

2.2.6.5 Reclosers and Sectionalizers

There are no reclosers or sectionalizers presently installed on the electrical distribution system. One of the many advantages of a grounded system is that the use of reclosers will be possible. Reclosers would reduce outage times and lineman callouts.

2.2.6.6 Capacitors and Reactors

There are no capacitors or reactors presently installed on the electrical distribution system. The power factor (PF) and load factor (LF) are consistently high on the distribution system, eliminating the need for voltage and VAR corrective devices.

2.3 FIELD INVESTIGATIONS

In order to evaluate the physical condition of the electric distribution system, the poles were tested using standard methods and equipment, and the line maintenance personnel were interviewed.

2.3.1 Pole Testing

A random sampling of seven poles were tested, including some of the oldest poles on the base, in order to gain some knowledge about the general condition of the overhead distribution system. EMC has estimated that 1,318 poles exist on the distribution system. Thus, approximately 0.5% of the poles were tested.

The testing was performed on Wednesday and Thursday, August 30 and 31, 1995. The weather was cold (high 30s to low 40s) and raining on Wednesday morning. The weather continued to improve through Thursday afternoon when it became sunny and warm (high 50s to low 60s). EMC was accompanied and assisted by a lineman from the Public Works Department during all pole testing. The test methods, data, and results are detailed below.

2.3.1.1 Test Methods

Four distinct methods were employed in order to evaluate the physical condition of the existing poles. They are described below.

Visual Inspection

The poles were visually inspected for:

- Checking: Checks are cracks or splits that develop along the longitudinal axis of the pole as the wood dries. They occur when the pole is not properly seasoned prior to preservative treatment. Checks are a problem because they expose the untreated wood at the center of the pole.

- Damage incurred from vehicles: One pole in Test No. 1 had large scars near the butt from snowplows. This pole is located in the middle of a large open parking and maneuvering area which makes it more vulnerable to incidents than others.

- Other abnormalities, such as excessive leaning: None of the poles inspected were leaning excessively.

Butt Drilling

The butts of the poles were drilled down into at a 45° angle starting at approximately 12 inches below the finished grade. A 3/8-inch diameter, 18-inch long ship auger was used with an electric drill. Two determinations are possible using this test method. First, the resistance of the drill as it enters the wood is used to determine if the interior of the pole is rotten. If the drill can be pushed into the wood with little applied force, then there is a strong possibility that the pole interior is rotten. Second, the wood shavings removed from the drill hole reveal the interior composition of the pole. An examination of the wood shavings will indicate the moisture content, and the existence of rot and insects. The drill holes were plugged with a 7/16" diameter, CCA treated, hickory dowel approximately 3 inches long.

Electronic (Sound Wave) Analysis

A Pole Test™ electronic testing device, manufactured by Engineering Data Management, Inc. (EDM) in Fort Collins, Colorado, was used to determine the strength of the pole at the ground line. The device uses sensors on the pole's surface to capture the waveform of a sound wave transmitted through the pole. The sound wave is injected into the pole by striking a metal pin on the pole's surface with a steel ball on a pendulum. The waveform is compared with known waveforms representing specific levels of deterioration of the pole's interior. The digital readout from the device is in psi and represents the strength left in the pole at the test location. The psi value can be compared against the cutoff limit published by EDM for the wood species and construction class of the pole under investigation.

The Pole Test™ unit was developed in conjunction with an Electric Power Research Institute (EPRI) grant to the Colorado State University to study pole failure prediction.

Hammer Strike

The pole was struck several times in several locations with a small sledge hammer. The sound of the strike is also indicative of the pole's condition. A sharp crack or ringing sound indicates a healthy, solid pole. A dull thud or soft sound indicates a rotted pole. The results of this test are more subjective than the first two, but provide additional substantiation to the results of those tests.

2.3.1.2 Data

The seven poles tested were located on the post as follows:

- Test No. 1 - Near Building 162 in the old post area.
- Test No. 2 - Near Building 400 in the middle post area.
- Test No. 3 - Near Building 400 in the middle post area.
- Test No. 4 - Near Building 100 in the old post area at Allen Air Field.
- Test No. 5 - Near the main gate at Big Delta Ave. and Richardson Highway.
- Test No. 6 - On the Bolio Lake line near where the line intersects the main road.
- Test No. 7 - ASP lateral feeder off of Feeder 7 near the sewage lagoon.

The pole data in Table 2-6 below was recorded during the testing. The pole ID, height, class and date were recorded directly from the poles when available. The butt diameter was actually measured with a caliper. The species and treatment type were deduced from color, smell, and other physical factors.

Table 2-6. Pole Data

Test No.	Pole ID	Height (ft)	Class	Date	Species	Diameter @ GL (in)	Preservative Treatment
1	F5L71	40	2	1948	Western Cedar	13.8	Copper
2	F531L4	50	2	1955	Western Cedar	14.3	Copper
3	F5L41	45	2	1985	Douglas Fir	15.2	Creosote
4	F5L88	45	2	1986	Western Cedar	13.0	Copper
5	F9L43	45	2	1957	Douglas Fir	13.6	Penta
6	None	45	3	1975	Western Cedar	13.7	Creosote
7	F7L61	45	3	1977	Douglas Fir	12.3	Unknown

The Pole Test™ data, presented in Table 2-7 below, was collected at the ground line (GL) and perpendicular (P) to the line in all cases except one. Due to site constraints, Test No. 1 was oriented at 45° to in-line (IL) with the line.

Table 2-7. Pole Test Data

Test No.	Visual Insp. Checking	Butt Drilling: Drill Resist.	Butt Drilling: Wood Shavings Moisture	Butt Drilling: Wood Shavings Rot	Pole Test™: Test Locate	Pole Test™: Accel. Orient.	Pole Test™: psi	Hammer Strike Sound
1	Severe	Moderate	Slight	No	GL	45° to IL	4500	Sharp
2	Severe	Moderate	Slight	No	GL	P	4260	Sharp
3	None	Moderate	Slight	No	GL	P	6180	Sharp
4	Few	Moderate	Slight	No	GL	P	4750	Sharp
5	Moderate	Strong	Slight	No	GL	P	6820	Sharp
6	Moderate	Strong	Slight	No	GL	P	5140	Sharp
7	Few	Strong	Slight	No	GL	P	6710	Sharp

The typical strength limits for evaluating the psi rating of a pole, based on the results of the Pole Test™ unit, vary with the pole species, the construction grade as defined by the National Electrical Safety Code (NESC), and the location on the pole where the test was made, i.e., ground line (GL) or local to some specific point or feature of the pole. Table 2-8 below defines the acceptable strength limits.

Table 2-8. Typical Strength Limits (psi)

	Douglas Fir		Southern Pine		Western Red Cedar	
Grade	**GL**	**Local**	**GL**	**Local**	**GL**	**Local**
B	3040	3400	4160	3390	2180	1900
C (Crossings)	2390	2550	2950	2600	1680	1560
C (Elsewhere)	3770	3960	4550	4110	2560	2450

It is observed that even for the most severe strength limits, the poles tested with the Pole Test™ unit exceed the ratings by more than 60% (the shaded areas in the tables above.) Pole testing notes recorded in the field are provided in Appendix C.

2.3.1.3 Pole Evaluation

Based on the field testing performed by EMC, the poles in the Fort Greely overhead electric distribution system are in good condition despite their age and the harsh environment.

2.3.2 Interviews

Conversations with the overhead line maintenance personnel from the Public Works Department indicated that there have not been any major problems with pole rot at or near the ground. They believe that the main causes of pole failure are damage from snowplows, carpenter ants (on the Cedar poles), and poles being jacked out of the ground by frost heave. They indicated that crossarm rot is prevalent. They have experimented with narrow profile Epoxirod™ construction, but returned to the 8-ft conventional wooden crossarms because the Epoxirod™ construction does not allow adequate working clearance for linemen between the phases. The line maintenance personnel believe that approximately 5% of the wooden crossarms need to be replaced at this time.

The linemen also stated that some 2.4 kV pin insulators still exist on the overhead distribution system, but most have been replaced with 15 kV class insulators. They estimate that approximately 15% of the pin insulators need to be replaced at this time. The insulators are damaged primarily by shot from bird hunter's shotguns. Some old 2.4 kV insulators still exist.

The main problem with the underground distribution system is the underground feeder from Feeder 9 to "the Condos," near the Texas Range. It is the single longest section of underground feeder. Because it was not originally buried deep enough, it is continually being moved to the surface by frost heave. Once on the surface, it is easily damaged requiring frequent splicing. The linemen believe that it should be replaced by an overhead line. As presently installed, it is difficult to maintain and troubleshoot.

2.3.3 Overall Evaluation

The generators and medium voltage switchgear were built in the mid-1950s and mid-1960s. Because the equipment is no longer in current production, it would be difficult or impossible to obtain replacement parts for it. The equipment has been well maintained throughout its service life and is in good condition. Based on plant records, the equipment has always been operated within the rated safe limits and is very reliable.

The overhead distribution system was built between the mid-1940s and the mid-1980s. Much like the generators and medium voltage switchgear, it has always been well maintained and operated within the rated safe limits. The overhead distribution system has been continually upgraded to the extent that most of it is presently suitable for operation at 4.16 kV. The physical condition of the system itself appears to be excellent. In fact, the least desirable part of the system is that it is operated ungrounded at 2.4 kV. Upgrading the distribution system to 4.16 kV would not substantially increase the mechanical loading on the existing poles, crossarms, or insulators. At worst, the addition of a new neutral conductor will require another guy wire at dead-end structures.

3. EXISTING SYSTEM COMPUTER MODELS AND ANALYSIS (1995 TO 1997)

3.1 GENERAL

The existing electrical distribution system was modeled using the Distribution Analysis for Power Planning and Reporting (DAPPER) Program, V4.5, Rev 1.08, as licensed to E M C Engineers, Inc. by SKM Systems Analysis, Inc. of Manhattan Beach, CA. The DAPPER Program is capable of modeling multi-level voltage power systems of any configuration, including radial design, loop design, or any combination of radial and loop design. The DAPPER Program can perform load flow, voltage drop, motor starting, and short circuit studies.

For the purpose of this study, the existing electrical distribution system was modeled and load flow analyses were performed for two cases: the existing system operated at 2400 V, and the existing system operated at 4160 V. The total system losses for each case were determined and compared to find the difference. The difference represents the reduction in losses attainable by operating the system at the higher voltage. The loss reduction can be easily converted to energy saved by multiplying by the average hours in service during the year.

Once the energy savings were known for the first year, the economic model was used to determine the SIR of operating the system at the higher voltage. The present worth of the energy savings was determined over a twenty year life. The construction costs required to modify the system for operation at the higher voltage were determined using the MCACES Program with the 1994 Fairbanks Database. The present worth of the energy savings was then divided by the construction costs, and the result was compared to the Corps of Engineers (COE) acceptable limits to determine the project's feasibility.

The electrical distribution system model and the economic model are described below in greater detail.

3.2 ELECTRICAL DISTRIBUTION SYSTEM MODEL

Before the electrical distribution system could be modeled accurately, several factors had to be determined. These are detailed in the following sections.

3.2.1 <u>Estimated Loads</u>

In order to estimate the system load accurately, data from the records maintained at Building 606 were analyzed. The monthly summary sheets were used to find the time and

date of the yearly peak between August 1, 1994 and July 31, 1995. Once the time and date of the yearly peak was known, the daily log sheets were used to determine the load on each feeder and the system power factor at the time. The yearly peak was determined to be 3456 kW occurring on December 7, 1994, at 12:00 PST. The system power factor was determined to be 95%. Table 3-1 below shows the loads on each feeder for December 7. Appendix D provides the load data sheets.

Table 3-1. Existing System Feeder Load

Feeder No.	Load (A)
1	125
2	122
3	85
4	100
5	60
6	Overhead Tie Bus
7	112
8	100
9	100
Total	**804**

Spreadsheets were created to calculate the estimated lumped load at each bus for each feeder, provided in Appendix E. The estimated load at each bus was calculated by multiplying the 3ϕ equivalent kVA by the estimated demand on the feeder. The estimated demand on the feeder was determined by trial and error, i.e., the demand necessary to produce the feeder ampacity, shown in the table above, in the actual computer model. The estimated lumped load is simply the total of all the transformers at a particular bus modeled as a "lump sum."

Lumping the loads at each bus represents a valid model for determining the system losses, since the voltage on the primary distribution system is the only factor that will be altered to reduce the system losses. The load transformer losses will be the same connected at 4.16 kV, grounded wye, as they are connected at 2.4 kV, delta. The secondary voltage on each load transformer will not change--the losses will remain the same. Consequently, it is not necessary to model the load transformers and the secondary loads in detail. Additionally, the feeder loads are based on measured data from plant records.

3.2.2 Load Factor

The load factor must also be considered in order to make the computer model more realistic. The initial loading of the distribution system was developed from the yearly peak. However, the system does not operate at the yearly peak all the time. The load factor times the yearly peak represents the average yearly loading of the system. The load factor for the Fort Greely electrical distribution system was determined by multiplying the daily peak for

each month by 24 (hours) and dividing the product by the sum of the hourly kW readings from the plant totalizer meter. The results for the twelve months were averaged to determine the yearly load factor, which is approximately 80%. Appendices D and K (Estimated Energy Savings) provide load factor calculations.

3.3 CASE STUDIES

Once the correct lumped loads were entered into the DAPPER Program and verified for each feeder, two load flow studies were performed to determine the system losses for each.

3.3.1 Case 1

Case 1 simulated the existing system operating at 2.4 kV with transformers connected in delta, where applicable. The loads were modeled for the 1995 to 1997 scenario as described above. One standby generator is running at 1000 kW and the remainder of the load is supplied through the GVEA transformer. The lumped loads are modeled as constant impedance loads. This case represents the baseline for the current system.

Appendix F provides for the results of the load flow study. The system losses are shown to be 76.1 kW and 239.2 kVAR.

3.3.2 Case 2

Case 2 simulated the existing system operating at 4.16 kV with transformers connected in grounded wye, where applicable. The loads were modeled for the 1995 to 1997 scenario as described above. One standby generator is running at 1000 kW and the remainder of the load is supplied through the GVEA transformer. An additional transformer has been added in this case to simulate the losses associated with stepping up the voltage at generators 1, 2, or 3 from 2.4 kV to 4.16 kV. The lumped loads were modeled as constant impedance loads. This case represents the reduced loss case for the current system.

Appendix G provides the results of the load flow study. The system losses are shown to be 44.2 kW and 242.8 kVAR.

3.4 CONSTRUCTION COST ESTIMATE

The construction cost estimates were developed based upon the repair, reconnection, replacement or addition of the distribution equipment as specified below. MCACES was used to develop the cost estimate with the 1994 Fairbanks database of material, labor and equipment costs. When cost information was not available in the MCACES database, vendor quotes or the 1995 Means Electrical Cost Data were used with a 20% location factor

added to account for the extra shipping expenses. Additionally, the following were applied to the construction cost estimate to obtain the final cost:

- 15% for contractor's overhead.
- 10% for contractor's profit.
- 3% for contractor's bond.
- 20% for contingency.
- 4% for price escalation.

The total construction cost for converting the electrical distribution system from 2400 V to 4160 V is $994,468. Appendix J provides detailed construction cost estimates. The equipment described below was included or excluded from the cost estimate.

3.4.1 <u>Transformers</u>

In order to operate the system at 4.16 kV, modifications to the distribution system transformers are required. These modifications are presented below.

3.4.1.1 Main Transformer (GVEA)

The main transformer is 3ϕ, 2500/3125 kVA, OA/FA, 24.9/14.4 - 2.4 kV connected YGRD-Δ and is owned and maintained by GVEA. It will be necessary to replace this transformer with a 3ϕ, 4000 kVA, OA, 24.9/14.4 - 4.16/2.4 kV transformer, connected YGRD-YGRD.

It is assumed for the purpose of this study that this transformer will be replaced by GVEA and the cost of replacement will be amortized over the life of the transformer. Those costs are generally incorporated into a new rate structure. Compared to the other modifications that will be necessary, this cost increase represents an insignificant investment on the part of Fort Greely. No costs have been included in the study for replacement of this transformer.

3.4.1.2 Feeder 9 Step-Up Substation Transformer

Feeder 9 consists of three 1ϕ, 500 kVA, OA, 2.4/4.16 -7.2/12.47 kV transformers with top mounted primary and secondary bushings, which are presently connected in a Δ-Δ configuration. They can be reconnected in a YGRD-YGRD configuration at minimal expense.

3.4.1.3 Richardson Step-Up Substation Transformer

The Richardson transformer consists of three 1ϕ, 200 kVA, OA, 2.4-7.2 kV transformers with top-mounted primary and secondary bushings, which are presently connected in a Δ-Δ configuration. They can be reconnected in a YGRD-YGRD configuration at minimal expense.

3.4.1.4 Building 606 Station Service Transformers

All four station service transformers at Building 606 will need to be replaced. They can all be replaced as 3ϕ dry type transformers at their original kVA ratings (2- 300 kVA & 2- 500 kVA) with primary windings of 4.16/2.4 kV connected YGRD, and secondary windings of 480/277 V connected YGRD.

3.4.1.5 Load Transformers

All 69 of the pole type load transformers are suitable for operation at 4.16 kV. The 3ϕ pole type load transformers are connected in Δ on the primary. They can be reconnected as YGRD at minimal expense. The secondaries will not require modifications.

All 76 1ϕ pole type transformers are connected phase-to-phase on the primary. They can be reconnected as phase-to-neutral at minimal expense. The secondaries will not require modifications.

In addition, the five pad-mounted transformers will need to be replaced:

> Four at 4160/2400-208/120 V, YGRD-YGRD (two 500 kVA; one 225 kVA; one 112.5 kVA).
>
> One at 12470/7200-208/120, YGRD-YGRD (500 kVA).

3.4.2 <u>Overhead Feeders</u>

The modifications required to the overhead distribution system feeders and structures in order to operate the system at 4.16 kV are described below.

3.4.2.1 Poles

No costs have been included in the construction cost estimate for replacement of poles as a result of upgrading the system voltage to 4.16 kV. The existing poles are in good condition.

3.4.2.2 Sagging

No costs have been included in the construction cost estimate for re-sagging the existing conductors as a result of upgrading the system voltage to 4.16 kV. Since the higher operating voltage will actually reduce the load current on the feeders, the normal operating sag will be reduced. There are some isolated spots where adequate clearance does not presently exist over roadways. These should be addressed with normal maintenance funds.

3.4.2.3 Crossarms

The existing crossarms are 8 ft in length as a minimum and provide adequate clearance for 4.16 kV operations. It is estimated that 5% (66) of the system crossarms need to be replaced at this time. The crossarm replacement is necessitated by normal rot experienced in the Alaska environment and not by the voltage upgrade. Since the cost is negligible, it has been included in the construction cost estimate.

3.4.2.4 Insulators

It is estimated that approximately 15% (594) of the system insulators are the old, 2400 V rated, glass insulators. All of these insulators should be replaced with 15 kV rated insulators. The cost for upgrading the system voltage has been included in the construction cost estimate.

3.4.2.5 Conductors

No costs have been included in the construction cost estimate for replacement of existing phase conductors. A new 4/0 AWG, ACSR neutral conductor and one new insulator per pole will need to be added to the overhead distribution system. The neutral will need to be grounded at 4 poles per mile, minimum. The cost of the new neutral, insulator, and grounds has been included in the construction cost estimate.

3.4.2.6 Guys

With the addition of the new neutral conductor, an additional guy wire may be necessary at dead-end and corner structures. The cost of this work is covered under the contingency.

3.4.3 <u>Underground Feeders</u>

No costs have been included in the construction cost estimate for modifications to any of the underground distribution feeders.

3.4.4 Generators

Generators. 1, 2, and 3 will each require a 3ϕ, 1500 kVA, 2400-4160/2400 V, Δ-YGRD step-up transformer in order to connect to the new grounded, higher voltage distribution system.

Generators 4 and 5 can be reconnected in a grounded wye configuration at their output terminals at minimal expense.

The costs of these modifications have been included in the construction cost estimate for upgrading the system voltage.

3.4.5 Medium Voltage Switchgear

No costs have been included in the construction cost estimate for modifications to the existing medium voltage switchgear.

3.4.6 Miscellaneous Equipment

The modifications required to the miscellaneous system equipment in order to operate the system at 4.16 kV are described below.

3.4.6.1 Richardson Step-Up Substation Breaker

This breaker will need to be replaced with a new oil circuit breaker rated for operation at 15 kV. The cost of this new breaker has been included in the construction cost estimate for upgrading the system voltage.

3.4.6.2 Load Break Air Switches

No costs have been included in the construction cost estimate for modifications to the existing load break air switches.

3.4.6.3 Cutout Switches

No costs have been included in the construction cost estimate for modifications to the existing cutout switches. Modifications required to fuse sizes will be covered under the contingency.

3.4.6.4 Protective Relays

A new Protective Device Coordination Study will be necessary and the existing relays will need to be reset. No costs have been included in the construction cost estimate specifically for these modifications. The cost of these modifications will be covered under the contingency.

3.4.6.5 Reclosers and Sectionalizers

No costs have been included in the construction cost estimate for modifications to reclosers or sectionalizers.

3.4.6.6 Capacitors and Reactors

No costs have been included in the construction cost estimate for modifications to capacitors or reactors.

3.5 ECONOMIC MODEL

The economic model used to calculate the Saving-to-Investment Ratio (SIR) was taken from the standard COE Life Cycle Cost Analysis (LCCA) Summary sheet developed for the Energy Conservation Investment Program (ECIP). The energy costs used are defined below. The construction cost estimates were described above.

3.5.1 Energy Costs

The energy costs used to calculate the energy savings were taken from the "Energy Usage and Cost Provided to Ft. Greely by GVEA" table (GVEA table) in Appendix K. The GVEA table was developed from GVEA's monthly billings to Fort Greely for the year beginning on September 1, 1993 and ending on August 31, 1994. The statements are also provided in Appendix K.

Fort Greely's energy costs are based on GVEA's GS-2 Rate Schedule, GVEA's wheeling charges, and the cost of generating electricity at Fort Wainwright. Rate schedules and calculations are provided to justify the numbers used in this study.

The average yearly energy cost for the purpose of this study was calculated as shown in Note 14 of the GVEA table. Approximately 85% of the power used by Fort Greely was generated at Fort Wainwright and wheeled to Fort Greely, and the remaining 15% was

purchased directly from GVEA. The average yearly energy cost was calculated by adding the two energy costs, each weighted by their respective percentages listed above.

The cost of power generated at Fort Wainwright and wheeled to Fort Greely was determined by multiplying the cost of generation at Fort Wainwright ($0.06/kWh) by the energy wheeled to Fort Greely (13,814,340 kWh) and adding to it the wheeling charge (17.64% of the GS-2 Rate Schedule), and multiplied by the energy wheeled to Fort Greely. The cost of GVEA power was determined by taking the total charges from GVEA ($528,806), subtracting their wheeling charges ($185,347), and dividing the difference by the total energy purchased from GVEA (2,503,020 kWh). This incorporates the demand charges into the energy charges over the entire year for convenience.

Based on the above calculation, the average yearly energy cost for Fort Greely is $0.0832 per kWh.

3.5.2 Economic Life and Discount Factor

The recommended economic life chosen for this project was 20 years based on Type 8, Electrical Energy Systems, from the Energy Conservation Project Types sheet in Appendix K.

The discount factor chosen was 14.47 Table Ba-4. This table is for Census Region 4 which includes Alaska and the DOE Discount Rate used is 4.1 percent as stated on the table.

These are the numbers that will be used in the LCCA.

3.5.3 Estimated Energy Savings

The estimated energy savings were calculated by subtracting the average line losses determined in the Case 2 Load Flow Analysis from the average line losses determined in the Case 1 Load Flow Analysis. In order to convert the peak power (kW) losses on the system to average annual energy (kWh) losses, the peak system losses were multiplied by the system load factor and the number of hours per year.

The average annual energy saved per year by converting the electrical distribution system from 2400 V to 4160 V is 222,330 kWh. Refer to the "Estimated Energy Savings" sheets in Appendix K.

3.5.4 LCCA

The standard COE LCCA was prepared using the numbers defined above. An additional 5.5% for supervision and inspection overhead (SIOH) and 6.0% for design costs were added to the total construction costs in the LCCA. This final sum represents the total investment

required to upgrade the electrical distribution system from a 2400 V, ungrounded delta to a 4160 V grounded wye. The total investment is $961,414.

The energy savings in dollars per year is $18,498. This number is calculated by multiplying the average annual energy saved per year at the base by the average yearly energy cost. The number is multiplied by the uniform present value (UPV) discount factor, which represents the total energy savings in dollars over the twenty year life of the project, reflected into the first year. This number calculates to $267,664.

A summary of the LCCA is shown below.

Table 3-2. LCCA Results for Existing System

Description	Existing System
Annual Energy Savings (kWh)	222,330
Annual Cost Savings ($)	18,498
Investment Cost ($)	1,108,832
Simple Payback (yrs)	59.9
SIR	0.24

There are no discernible non-energy savings in this project. The age and voltage (2400 V) of most of the existing equipment that will be replaced renders the salvage value negligible. Likewise, there is no public utility rebate for the improvements under consideration in this report.

The SIR for this project is 0.24. Since this value is less than 1.25, the project does not qualify for implementation under the ECIP Program.

4. REDUCED SYSTEM DESCRIPTION (POST 2001)

4.1 GENERAL

The Department of Defense has targeted Fort Greely for realignment under the Base Realignment and Closure (BRAC) Program. The base realignment will significantly reduce the number of active facilities on the site over a five year period, starting in 1997 and ending in 2001. This reduction in facilities will have a significant impact on the utilization of the electrical distribution system and, consequently, the energy savings achievable.

4.2 DETAILS

The major features of each of the electric distribution systems are described in detail below as they will exist after realignment. The post-realignment system will be referred to as the reduced system.

4.2.1 Buildings

There are currently 231 buildings located on Fort Greely, the majority of which will be "laid-away" under the Layaway Program for disposition or eventual demolition. Twenty-eight buildings have been identified for retention to support the residual force to be left at Fort Greely. These buildings total 245,937 sq ft consisting of the buildings associated with the primary base services, such as fire protection, central power and heating plant, police, headquarters, sewage plant, school, gymnasium, housing, roads and grounds, etc.

Twenty-five of these buildings receive electric service via the base distribution system. Only 16 buildings are located in the cantonment area. The nine remote sites are located in the Bolio Lakes and Ranges area southwest of the base. Three buildings located in the Black Rapids area do not receive electric service via the base distribution system, and were not considered in this study.

4.2.2 Transformers

The residual buildings will be supplied by a total of 66 transformers from the Fort Greely electric distribution system. Of those transformers, 56 actually supply building loads, six are step-up substation transformers on Feeder. 9, and four are station service transformers for Building 606. All remaining transformers are described in detail below.

4.2.2.1 Main Transformer (GVEA)

The main transformer supplies the base from the GVEA distribution system. It is a 2500/3125 kVA, OA/FA, 24.9/14.4 - 2.4 kV, YGRD-Δ substation class transformer with top mounted primary and secondary bushings. This transformer is located adjacent to Building 606, and is owned and maintained by GVEA. It is not included as part of the 66 transformers described above, but will remain after realignment.

This transformer will need to be replaced if the Fort Greely electric distribution system is upgraded to 4.16 kV, grounded wye. It will be necessary to coordinate with GVEA on the exact winding configuration.

4.2.2.2 Feeder 9 Step-Up Substation Transformer

The Feeder 9 substation consists of 3, 1ϕ, 500 kVA, OA, 2.4/4.16 - 7.2/12.47 kV pole-mounting type transformers, connected Δ-Δ, with top mounted primary and secondary bushings. The transformers are mounted on a concrete pad adjacent to Building 606, and will remain after realignment.

These transformers can be rewired as a grounded wye (YGRD) on both the primary and secondary and reused if the system voltage is increased to 4.16 kV. This will increase the Feeder 9 voltage from 7200 V to 12,470 V.

4.2.2.3 Richardson Step-Up Substation Transformer

The Richardson substation consists of three 1ϕ, 200 kVA, OA, 2.4 - 7.2 kV pole-mounting type transformers, connected Δ-Δ, with top mounted primary and secondary bushings. The transformers are mounted on a concrete pad near the Richardson Highway in the West Post area.

The nameplate on the transformers does not specifically indicate that the transformers are rated for operation at 4.16 kV and 12.47 kV. However, EMC believes that these transformers can be rewired as a grounded wye (YGRD) on both the primary and secondary and reused at 4.16 kV and 12.47 kV respectively. The winding voltage and insulator bushing ratings will not change and the phase-to-phase clearance is adequate. It will be necessary to rewire these transformers to match the Feeder 9 step-up transformer voltage. These transformers will remain after realignment.

4.2.2.4 Building 606 Station Service Transformers

Building 606, is supplied by four station service transformers: SS-1, SS-2, and two SM1As. Transformer SS-1 is a 300 kVA dry type transformer. Transformer SS-2 is a 300 kVA pad

mounted transformer. Both SM1A transformers are 500 kVA dry type transformers. All four transformers are 3ϕ, 2400-480 V, Δ-Δ, and will remain after realignment. They will all need to be replaced if the system voltage is upgraded to 4.16 kV, because they cannot be rewired.

4.2.2.5 Load Transformers

From the 56 load supplying transformers mentioned above, 1 is a 3ϕ pad mounted transformers, 51 are connected into 17, 3ϕ transformer banks, and the remaining 4 are 1ϕ transformer banks. Table 4-1 below shows the transformer voltages, sizes, quantities, and mounting type. All 3ϕ transformers are connected Δ-YGRD and 1ϕ transformers are connected ϕ-ϕ on the primary with a center tapped secondary.

Table 4-1. Remaining Load Transformers

(Permanent Activity Facility list as of July 25, 1995)

Bldg. No.	Bldg. Name	Location	No. Trans. Banks	Trans. Bank kVA	No. of Trans./ Bank	ϕ	Mt. Type	VPRI	VSEC
110	POL Monitoring	North Post	1	75	3	3	Pole	2400	208/120
501	Headquarters	Cantonment	1	225	3	3	Pole	2400	208/120
503	Gymnasium	Cantonment	1	225	3	3	Pole	2400	208/120
504	Fire Station	Cantonment	1	112.5	3	3	Pole	2400	208/120
605	Consol. PW	Cantonment	1	300	3	3	Pole	2400	208/120
606	Central Htg. Plant	Cantonment	1	150	3	3	Pole	2400	480/277
607	Heat Plant Annex	Cantonment							
615	Roads & Grounds	Cantonment	1	150	3	3	Pole	2400	208/120
617	POL Operation	Cantonment							
618	POL Operation	Cantonment	1	75	3	3	Pole	7200	208/120
633	Sewage Treat.	Cantonment	1	30	3	3	Pole	2400	208/120
638	Sewage Lagoon	Cantonment	1	75	3	3	Pole	2400	480/277
639	Contact Chamber	Cantonment							
725	State School	Cantonment	1	225	3	3	Pole	2400	208/120
820	Unac. Pers. Hsg.	Cantonment	2	37.5	1	1	Pole	2400	240/120
821	Unac. Pers. Hsg.	Cantonment	1	75	1	1	Pole	2400	240/120
1343	Range	Beales	1	30	3	3	Pole	7200	208/120
1350	Range	Beales	1	75	3	3	Pole	7200	208/120
1352	Range	Beales							
1419	Range	Mississippi	1	112.5	3	3	Pole	7200	208/120
			1	30	3	3	Pole	7200	208/120
1600	Range	Texas	1	75	3	3	Pole	7200	208/120
1605	Range	Texas	1	15	1	1	Pole	7200	240/120
1606	Range	Texas							
1928	CRTA Complex	Bolio Lake	1	500	1	3	Pad	7200	208/120
1930	CRTA Complex	Bolio Lake	1	150	3	3	Pole	7200	208/120
2013	NWTC Complex	Black Rapids	Not served from the base distribution system.						
2019	NWTC Complex	Black Rapids							
2026	NWTC Complex	Black Rapids							

All pad-mounted transformers will need to be replaced if the distribution system voltage is increased to 4.16 kV and 12.47 kV. The 3ϕ, pole-mounted transformer primaries can be

rewired to a grounded wye configuration and reused. The 1ϕ, pole mounted transformers can be rewired from ϕ-ϕ to ϕ-N and reused. The winding voltage and insulator bushing ratings will not change.

4.2.3 Feeders

The load transformers are supplied by six feeders comprised of 23.1 miles of overhead lines and 3.4 miles of underground lines. Feeders 3, 4, and 8 from the original distribution system are no longer required and are taken completely out of service. Several other feeders are reduced in overall length. The electric distribution system is operated as an ungrounded delta at 2400 volts, 3ϕ. Table 4-2 shows the feeder characteristics.

Table 4-2. Feeder Descriptions

Feeder	Length & Size				Voltage	Connected kVA	
No.	OH (ft)	AWG	UG (ft)	AWG	L-L	3 ϕ	1 ϕ
1	5050	4/0	0	-	2400	225	150
2	1550	4/0	0	-	2400	562.5	0
3	0	4/0	0	-	2400	0	0
4	0	4/0	0	-	2400	0	0
5	8400	4/0	2400	2	2400	75	0
6	0	Bus	0	-	2400	0	0
7	3550	4/0	0	-	2400	705	0
8	0	4/0	2000	4/0	2400	0	0
9	103,418	2	13,552	2	7200	1017.5	25
Totals	**121,968**		**17,952**			**2585**	**175**

Approximately 94% of the connected load will be three-phase after realignment. It is assumed that the single-phase loads will remain well balanced between phases. In general, the feeders will supply the same loads and locations as previously described, except the loads that have been eliminated:

- Feeder No. 1 - Housing in the main base area.
- Feeder No. 2 - Offices and shops in the main base area.
- Feeder No. 3 - No load
- Feeder No. 4 - No load
- Feeder No. 5 - Old and middle post areas; Allen Air Field.
- Feeder No. 6 - Overhead tie.
- Feeder No. 7 - Sewage plant and east base area.
- Feeder No. 8 - No load
- Feeder No. 9 - Remote sites; Bolio Lakes and the Ranges.

4.2.3.1 Overhead Feeder Construction

Approximately 87% of the electric distribution system, by feeder length, will be overhead construction after realignment. The overhead electric distribution system construction is the same as previously described in Section 2.

None of the phase conductors will have to be replaced if the system voltage is upgraded to 4.16 kV and 12.47 kV. The load current will actually be decreased at the higher voltages. The previous assumption will be made, that 5% of the crossarms will have to be replaced and 15% of the pin insulators. A new neutral conductor will have to be added as well.

4.2.3.2 Underground Feeder Construction

The remaining 13% of the electric distribution system is underground construction. The underground electric distribution system is constructed as previously described in Section 2.

It is not necessary to replace the feeders or add an additional wire for a neutral if the system voltage is upgraded to 4.16 kV and 12.47 kV. The three-phase feeders supply balanced three-phase loads. No single-phase loads were supplied by underground feeders.

4.2.4 Generators

The five diesel engine generators located in Building 606 will remain after realignment. Generators 1, 2, and 3 are alike and generators 4 and 5 are alike. Table 4-2 is a summary of the generators characteristics.

Table 4-3. Characteristics of Engine Generators

Gen. No.	Rated kVA	PF	Rated kW	rpm	ϕ	Voltage	Mfr.	Ser. No.	Output Connect.
1	1250	0.8	1000	360	3	2400	Elliott Co.	3-S-9691	Y
2	1250	0.8	1000	360	3	2400	Elliott Co.	2-S-9691	Y
3	1250	0.8	1000	360	3	2400	Elliott Co.	1-S-9691	Y
4	1563	0.8	1250	360	3	2400/4160	Elliott Co.	4-S-10915	Δ
5	1563	0.8	1250	360	3	2400/4160	Elliott Co.	7-S-10915	Δ

The generators are usually operated as peak shavers to reduce the load on the GVEA main transformer. The total connected load on the reduced system, counting the load and station service transformers is approximately 4160 kVA. If the traditional operating characteristics of the base load are assumed, i.e., 95% power factor and 25% demand factor, the peak base load will be approximately 988 kW. Hence, the main GVEA transformer will be more than

adequately sized and generators 4 and 5 are each large enough to provide stand-by power to the reduced base with one unit in reserve.

All of the generators are 6-lead machines. Generators 1, 2, and 3 are connected in an ungrounded Y configuration, meaning that the T1, T2, and T3 leads are connected to phases A, B, and C respectively and the T4, T5, and T6 leads are tied together at a common neutral bus is not bonded to ground. This indicates that the windings are only rated for 1386 V. If these generators are to be used on a 4160 V, grounded wye system, they will require a 2.4 - 4.16 kV, Δ-YGRD step-up transformer.

Generators 4 and 5, on the other hand, are connected in a delta configuration, meaning that the T1 and T3 leads are tied together, the T2 and T4 leads are tied together, and the T3 and T5 leads are tied together. This indicates that the windings are rated for 2400 V and that these generators can be used on a 4160 V, grounded wye system by reconnecting the leads from a delta configuration to a grounded wye configuration.

If generators 4 and 5 alone were kept for stand-by purposes, and generators 1,2 and 3 were laid-away, a considerable savings could be realized when upgrading the system to 4160 V, by not having to install a new transformer at each of generators 1, 2 and 3. The economic impact of this decision is discussed in Section 6.

4.2.5 Medium Voltage Switchgear

The main switchgear at Building 606 will remain the same as previously described after realignment. The equipment ratings will not change and the fault levels will remain substantially the same. As previously described, the high first half cycle fault levels are not expected to be a problem.

It will not be necessary to replace any of the switchgear if the system voltage is upgraded to 4.16 kV. The existing switchgear is rated for 4.16 kV and the bus ampacities will be more than adequate, since the load current will be reduced to 58% of its present value at the higher voltage. Additionally, the available fault currents will decrease with the increased voltage.

4.2.6 Miscellaneous Equipment

4.2.6.1 Richardson Step-Up Substation Breaker

The oil circuit breaker at this location is an Allis Chalmers Type OX-18 (Serial No. 305756). It is rated for 600 A continuous current, 7.2 kV and 75 kV BIL. It was manufactured in December 1955. Since it is only rated for 7.2 kV phase-to-phase, it will have to be replaced with a switch rated for 15 kV phase-to-phase.

4.2.6.2 Load Break Air Switches

These sectionalizer switches are relatively new additions to the overhead distribution system and are A B Chance, Type D, Catalogue No. CD7HE1CL. They are rated for 600 A continuous current, 40 kA momentary current, 15 kV, and 110 kV BIL. These switches will not have to be replaced if the system voltage is increased to 4.16 and 12.47 kV.

4.2.6.3 Cutout Switches

Each load transformer is protected by an XS style cutout switch. The rating of the cutouts is not known, however, they have only been available in a 15 kV rating for many years. In addition, a 200 A continuous current rating is commonly used on overhead distribution systems, especially in conjunction with 4/0 ACSR. Therefore, it is assumed that the cutouts are rated at 200 A continuous current, 15 kV, and 110 kV BIL, the standard rating available from most manufacturers. While the cutouts will not have to be replaced, their fuses will all have to be replaced if the voltage is upgraded to 4.16 kV and 12.47 kV. The National Electrical Code (NEC, Table 450-3(a)(1)) requires that the continuous current rating of the primary protection for a transformer not exceed 300% of the rated continuous primary current of the transformer. Since the primary current of the transformer will be reduced to 58% of its original value because of the voltage increase, all of the fuses will be too large.

4.2.6.4 Protective Relays

A Protective Device Coordination Study was recently performed and the protective devices reset to the recommended values. If the system voltage is increased, the load and fault current levels will all change. This will require that any current sensing type protective device be reset in order to maintain coordinated tripping and to ensure proper protection. Table 4-4 below shows the devices with current sensitive tripping that will need to be reset.

Table 4-4. Protective Devices With Current Sensing

Item No.	Bus	Equipment	Device Type	Quantity
1	Gray Switchgear South	Generator No. 1	51V	3
2	Gray Switchgear South	Generator No. 2	51V	3
3	Gray Switchgear South	Generator No. 3	51V	3
4	Gray Switchgear South	Feeder No. 1	50/51	3
5	Gray Switchgear South	Feeder No. 3	50/51	0
6	Gray Switchgear South	Feeder No. 4	40/51	0
7	Gray Switchgear South	Feeder No. 2	50/51	3
8	Gray Switchgear South	Feeder No. 5	50/51	3
9	Gray Switchgear South	Station Service No. 1	50/51	3
10	Gray Switchgear South	SM1A Tie	50/51	3
11	Gray Switchgear North	Generator No. 4	51V	3

Item No.	Bus	Equipment	Device Type	Quantity
12	Gray Switchgear North	Generator No. 5	51V	3
13	Orange Switchgear	GVEA Transformer	50/51	3
14	Orange Switchgear	GVEA Transformer	46	1
15	Orange Switchgear	Feeder No. 7	50/51	3
16	Orange Switchgear	Feeder No. 8	50/51	0
17	Orange Switchgear	Feeder No. 9	50/51	3
18	Orange Switchgear	Overhead Tie	50/51	3
19	Orange Switchgear	Station Service No. 2	50/51	3
Total				**46**

The quantity to be reset is slightly less than described in Section 2 for the existing system, because three feeders are assumed to be out of service due to the reduced facility. It is believed that the CTs will not need to be replaced with smaller ratio CTs. The range of tap settings available on the protective relays will allow them to be reset to the new current values.

With the system configuration changed to a grounded wye, and the Building 606 and Richardson substation step-up transformers rewired to grounded wye configurations on both the primary and secondary, the 7.2 kV system will have ground fault protection, which it presently does not have.

4.2.6.5 Reclosers and Sectionalizers

There are no reclosers or sectionalizers presently installed on the electrical distribution system. One of the many advantages of a grounded system is that the use of reclosers will be possible. Reclosers would reduce outage times and lineman callouts.

4.2.6.6 Capacitors and Reactors

There are no capacitors or reactors presently installed on the electrical distribution system. The power factor (PF) and load factor (LF) are consistently high on the distribution system, eliminating the need for voltage and VAR corrective devices.

5. REDUCED SYSTEM COMPUTER MODELS AND ANALYSIS (POST 2001)

5.1 GENERAL

The reduced electrical distribution system was modeled in the Distribution Analysis for Power Planning and Reporting (DAPPER) Program, V4.5, Rev 1.08, as licensed to E M C Engineers, Inc. by SKM Systems Analysis, Inc. of Manhattan Beach, CA. The DAPPER Program is capable of modeling multi-level voltage power systems of any configuration, including radial design, loop design, or any combination of radial and loop design. The DAPPER Program can perform load flow, voltage drop, motor starting and short circuit studies.

For the purpose of this study, the reduced electrical distribution system was modeled and load flow analyses were performed for two cases: the reduced system operated at 2400 V, and the reduced system operated at 4160 V. The total system losses for each case were determined and compared to find the difference. The difference represents the reduction in losses attainable by operating the system at the higher voltage. The loss reduction can be easily converted to energy saved by multiplying by the average hours in service during the year.

Once the energy savings were known for the first year, the economic model was used to determine the savings-to-investment ratio (SIR) of operating the system at the higher voltage. The present worth of the energy savings was determined over a twenty year life. The construction costs required to modify the system for operation at the higher voltage were determined using the MCACES Program with the 1994 Fairbanks Database. The present worth of the energy savings was then divided by the construction costs, and the result was compared to the Corps of Engineers (COE) acceptable limits to determine the feasibility of the project.

The electrical distribution system model and the economic model are described below in greater detail.

5.2 ELECTRICAL DISTRIBUTION SYSTEM MODEL

Before the electrical distribution system could be modeled accurately, several factors had to be determined. These are detailed in the following sections.

5.2.1 Estimated Loads

In order to estimate the system load accurately to model the reduced system, the data used in the existing system model from Section 3 was modified as follows:

- Transformers for buildings to be laid-away were taken out of service.
- Feeders with no building loads remaining were taken out of service.
- Estimated demand for each feeder still in service in the reduced system model was assumed to be the same as in the existing system model.
- Power Factor for each feeder still in service in the reduced system model was assumed to be the same as in the existing system model.

The data used in the reduced system model in was developed from the lumped load calculations used for the existing system model. Table 5-1 below shows the feeder loads used in the reduced system computer model. The data sheets are provided in Appendix D.

Table 5-1. Feeder Load for Reduced Systems

Feeder No.	Load (A)
1	40
2	55
3	0
4	0
5	2
6	Overhead Tie Bus
7	49
8	0
9	21
Total	**167**

Spreadsheets were created to calculate the estimated lumped load at each bus for each feeder, provided in Appendix E as the Lumped Load Calculation Post 2001 Study. The estimated load at each bus was calculated by multiplying the 3 Phase Equivalent kVA by the estimated demand on the feeder. The estimated demand on each feeder was left the same as used in the existing system model. The estimated lumped load is simply the total of all the transformers at a particular bus modeled as a "lump sum."

Lumping the loads at each bus represents a valid model for determining the system losses, since the voltage on the primary distribution system is the only factor that will be altered to reduce the system losses. The load transformer losses will be the same connected at 4.16 kV, grounded wye as they are connected at 2.4 kV, delta. The secondary voltage on each

load transformer will not change, so the losses will remain the same. Consequently, it is not necessary to model the load transformers and the secondary loads in detail. Additionally, the feeder loads are based on measured data from plant records.

5.2.2 Load Factor

The load factor that must be considered in order to make the computer model more realistic, and that is the load factor. The initial loading of the distribution system was developed from the yearly peak. The system does not operate at the yearly peak all the time, however. The load factor times the yearly peak represents the average yearly loading of the system. The load factor for the Fort Greely electrical distribution system was determined by multiplying the daily peak for each month times 24 (hours) and dividing the product by the sum of the hourly kW readings from the plant totalizer meter. The results for the twelve months were averaged to determine the yearly load factor, which is approximately 80%. The assumption was made that the yearly load factor will remain the same after realignment has reduced the base. Load factor calculations are provided in Appendices D and K (Estimated Energy Savings).

5.3 CASE STUDIES

Once the correct lumped loads were entered into the DAPPER Program and verified for each feeder, two load flow studies were performed to determine the system losses for each.

5.3.1 Case 3

Case 3 simulated the reduced system operating at 2.4 kV with transformers connected in delta where applicable. The loads were modeled for the Post 2001 scenario as described above. One standby generator is running at 1000 kW and the remainder of the load is supplied through the GVEA transformer. The lumped loads are modeled as constant impedance loads. This case represents the baseline for the reduced system.

Appendix H provides the results of the load flow study. The system losses are shown to be 13.6 kW and 13.9 kVAR.

5.3.2 Case 4

Case 4 simulated the reduced system operating at 4.16 kV with transformers connected in grounded wye where applicable. The loads were modeled for the Post 2001 scenario as described above. One standby generator is running at 1000 kW and the remainder of the load is supplied through the GVEA transformer. An additional transformer has been added in this case to simulate the losses associated with stepping up the voltage at

generators 1, 2, or 3 from 2.4 kV to 4.16 kV. The lumped loads were modeled as constant impedance loads. This case represents the reduced loss case for the reduced system.

The results of the load flow study are provided in Appendix I. The system losses are shown to be 11.2 kW and 44.1 kVAR.

5.4 CONSTRUCTION COST ESTIMATE

The construction cost estimates were developed based upon the repair, reconnection, replacement or addition of the distribution equipment as specified below. MCACES was used to develop the cost estimate with the 1994 Fairbanks database of material, labor and equipment costs. When cost information was not available in the MCACES database, vendor quotes or the 1995 Means Electrical Cost Data were used with a 20% location factor added to account for the extra shipping expenses. Additionally, the following adders were applied to the construction cost estimate to obtain the final cost:

- 15% for contractor's overhead.
- 10% for contractor's profit.
- 3% for contractor's bond.
- 20% for contingency.
- 4% for price escalation.

The total construction cost for converting the electrical distribution system from 2400 V to 4160 V is $714,073.

Detailed construction cost estimates are provided in Appendix J. The equipment described below was included or excluded from the cost estimates.

5.4.1 <u>Transformers</u>

The modifications required to the distribution system transformers in order to operate the system at 4.16 kV are described below.

5.4.1.1 Main Transformer (GVEA)

The main transformer is 3ϕ, 2500/3125 kVA, OA/FA, 24.9/14.4 - 2.4 kV transformer is connected YGRD-Δ and is owned and maintained by GVEA. It will be necessary to replace this transformer with a 3ϕ, 4000 kVA, OA, 24.9/14.4 - 4.16/2.4 kV transformer, connected YGRD-YGRD.

The size of this transformer could be reduced to 2000 kVA due to the reduced load. It was assumed, however, that the facilities that are laid-away could be reactivated in an

emergency, and capacity will need to be available. It is also assumed for the purpose of this study that this transformer will be replaced by GVEA and the cost of replacement will be amortized over the life of the transformer. those costs are generally incorporated into a new rate structure. Compared to the other modifications that will be necessary, this cost increase represents an insignificant investment on the part of Fort Greely. No costs have been included in the study for replacement of this transformer.

5.4.1.2 Feeder 9 Step-Up Substation Transformer

The Feeder 9 transformer will be required in the reduced system. It consists of three 1ϕ, 500 kVA, OA, 2.4/4.16 -7.2/12.47 kV transformers with top mounted primary and secondary bushings, which are presently connected in a Δ-Δ configuration. They can be reconnected in a YGRD-YGRD configuration at minimal expense.

5.4.1.3 Richardson Step-Up Substation Transformer

The Richardson transformer will be required in the reduced system. It consists of three 1ϕ, 200 kVA, OA, 2.4-7.2 kV transformers with top mounted primary and secondary bushings, which are presently connected in a Δ-Δ configuration. They can be reconnected in a YGRD-YGRD configuration at minimal expense.

5.4.1.4 Building 606 Station Service Transformers

All four station service transformers will be required in the reduced system, but will need to be replaced. They can all be replaced as 3ϕ dry type transformers at their original kVA ratings (2- 300 kVA & 2- 500 kVA) with primary windings of 4.16/2.4 kV connected YGRD, and secondary windings of 480/277 V connected YGRD.

5.4.1.5 Load Transformers

All 51 pole type load transformers are suitable for operation at 4.16 kV. The 3ϕ pole type load transformers are connected in Δ on the primary. They can be reconnected as YGRD at minimal expense. The secondaries will not require modifications.

Four 1ϕ pole type transformers are connected phase-to-phase on the primary. They can be reconnected as phase-to-neutral at minimal expense. The secondaries will not require modifications.

One pad-mounted transformer will need to be replaced on the 3ϕ, 500 kVA unit at Bolio Lakes.

5.4.2 Overhead Feeders

The modifications required to the overhead distribution system feeders and structures in order to operate the system at 4.16 kV are described below.

5.4.2.1 Poles

No costs have been included in the construction cost estimate for replacement of poles as a result of upgrading the system voltage to 4.16 kV. The existing poles are in good condition.

5.4.2.2 Sagging

No costs have been included in the construction cost estimate for re-sagging the existing conductors as a result of upgrading the system voltage to 4.16 kV. Since the higher operating voltage will actually reduce the load current on the feeders, the normal operating sag will be reduced. There are some isolated spots where adequate clearance does not presently exist over roadways. These should be addressed with normal maintenance funds.

5.4.2.3 Crossarms

The existing crossarms are 8 ft in length as a minimum and provide adequate clearance for 4.16 kV operations. It is estimated that 5% (49) of the system crossarms need to be replaced at this time. The crossarm replacement is necessitated by normal rot experienced in the Alaska environment and not by the voltage upgrade. Since the cost is negligible, it has been included in the construction cost estimate.

5.4.2.4 Insulators

It is estimated that approximately 15% (440) of the system insulators are the old, 2400 V rated, glass insulators. All of these insulators should be replaced with 15 kV rated insulators. The cost for upgrading the system voltage has been included in the construction cost estimate.

5.4.2.5 Conductors

No costs have been included in the construction cost estimate for replacement of existing phase conductors. A new 4/0 AWG, ACSR neutral conductor and one new insulator per pole will need to be added to the overhead distribution system. The neutral will need to be grounded at 4 poles per mile, minimum. The cost of the new neutral, insulator, and grounds has been included in the construction cost estimate.

5.4.2.6 Guys

With the addition of the new neutral conductor, an additional guy wire may be necessary at dead-end and corner structures. The cost of this work is covered under the contingency.

5.4.3 Underground Feeders

No costs have been included in the construction cost estimate for modifications to any of the underground distribution feeders.

5.4.4 Generators

Generators 1, 2, and 3 will each require a 3ϕ, 1500 kVA, 2400-4160/2400 V, Δ-YGRD step-up transformer in order to connect to the new grounded, higher voltage distribution system.

Generators. 4 and 5 can be reconnected in a grounded wye configuration at their output terminals at minimal expense.

The costs of these modifications have been included in the construction cost estimate for upgrading the system voltage. Additional cost savings could be realized by laying-away generators 1, 2 and 3.

5.4.5 Medium Voltage Switchgear

No costs have been included in the construction cost estimate for modifications to the existing medium voltage switchgear.

5.4.6 Miscellaneous Equipment

The modifications required to the miscellaneous system equipment in order to operate the system at 4.16 kV are described below.

5.4.6.1 Richardson Step-Up Substation Breaker

This breaker will need to be replaced with a new oil circuit breaker rated for operation at 15 kV. The cost of this new breaker has been included in the construction cost estimate for upgrading the system voltage.

5.4.6.2 Load Break Air Switches

No costs have been included in the construction cost estimate for modifications to the existing load break air switches.

5.4.6.3 Cutout Switches

No costs have been included in the construction cost estimate for modifications to the existing cutout switches. Modifications required to fuse sizes will be covered under the contingency.

5.4.6.4 Protective Relays

A new Protective Device Coordination Study will be necessary and the existing relays will need to be reset. No costs have been included in the construction cost estimate specifically for these modifications. The cost of these modifications will be covered under the contingency.

5.4.6.5 Reclosers and Sectionalizers

No costs have been included in the construction cost estimate for modifications to reclosers or sectionalizers.

5.4.6.6 Capacitors and Reactors

No costs have been included in the construction cost estimate for modifications to capacitors or reactors.

The total construction cost for converting the electrical distribution system from 2400 V to 4160 V is $714,073.

5.5 ECONOMIC MODEL

The economic model used to calculate the Saving-To-Investment Ratio (SIR) was taken from the standard COE Life Cycle Cost Analysis (LCCA) Summary sheet developed for the Energy Conservation Investment Program (ECIP). The energy costs used are defined below, and the construction cost estimates were described above.

5.5.1 Energy Costs

The energy costs used to calculate the energy savings were taken from the "Energy Usage and Cost Provided to Ft. Greely by GVEA" table (GVEA table) in Appendix K. The table was developed from GVEA's monthly billings to Fort Greely for the year beginning on September 1, 1993 and ending on August 31, 1994. The statements are provided in Appendix K.

Fort Greely's energy costs are based on GVEA's GS-2 Rate Schedule, GVEA's wheeling charges, and the cost of generating electricity at Fort Wainwright. Rate schedules and calculations are provided to justify the numbers used in this study.

The average yearly energy cost for the purpose of this study was calculated as shown in Note 14 of the GVEA table. Approximately 85% of the power used by Fort Greely was generated at Fort Wainwright and wheeled to Fort Greely. The remaining 15% was purchased directly from GVEA. The average yearly energy cost was calculated by adding the two energy costs, each weighted by their respective percentages listed above.

The cost of power generated at Fort Wainwright and wheeled to Fort Greely was determined by multiplying the cost of generation at Fort Wainwright ($0.06/kWh) by the energy wheeled to Fort Greely (13,814,340 kWh) and adding to it the wheeling charge (17.64% of the GS-2 Rate Schedule) times the energy wheeled to Fort Greely. The cost of GVEA power was determined by taking the total charges from GVEA ($528,806), subtracting their wheeling charges ($185,347), and dividing the difference by the total energy purchased from GVEA (2,503,020 kWh). This incorporates the demand charges into the energy charges over the entire year for convenience.

Based upon the calculations above, the average yearly energy cost for Fort Greely is $0.0832 per kWh.

5.5.2 Economic Life and Discount Factor

The recommended economic life chosen for this project was 20 years based on Type 8, Electrical Energy Systems, on the Energy Conservation Project Types sheet in Appendix K.

The discount factor chosen was 14.47 from the "Industrial (Elec)" column and "N=20" row of Table Ba-4, the "FEMP UPV* Discount Factors adjusted for fuel price escalation, by end-use and fuel type" table in Appendix K. This table is for Census Region 4 which includes Alaska, and the DOE Discount Rate used was 4.1 percent as stated on the table.

5.5.3 Estimated Energy Savings

The estimated energy savings were calculated by subtracting the average line losses determined in the Case 4 Load Flow Analysis from the average line losses determined in

the Case 3 Load Flow Analysis. In order to convert the peak power (kW) losses on the system to average annual energy (kWh) losses, the peak system losses were multiplied by the system load factor and the number of hours per year.

The average annual energy saved per year by converting the electrical distribution system from 2400 V to 4160 V is 16,727 kWh. Refer to the "Estimated Energy Savings" sheets in Appendix K.

5.5.4 LCCA

The standard COE LCCA was prepared using the numbers defined above. An additional 5.5% for supervision and inspection overhead (SIOH) and 6.0% for design costs were added to the total construction costs in the LCCA. This final sum represents the total investment required to upgrade the electrical distribution system from a 2400 V, ungrounded delta to a 4160 V grounded wye. The total investment is $796,191.

The energy savings in dollars per year is $1,392. This number is calculated by multiplying the average annual energy saved per year at the base by the average yearly energy cost. The number is multiplied by the uniform present value (UPV) discount factor, which represents the total energy savings in dollars over the twenty year life of the project, reflected into the first year. This number calculates to $20,138.

A summary of the LCCA is shown in Table 5-2 below.

Table 5-2. LCCA Results

Description	Reduced System
Annual Energy Savings (kWh)	16,727
Annual Cost Savings ($)	1,392
Investment Cost ($)	796,191
Simple Payback (yrs)	572.1
SIR	0.03

There are no discernible non-energy savings in this project. The age and voltage (2400 V) of most of the existing equipment that will be replaced renders the salvage value negligible. Likewise, there is no public utility rebate for the improvements under consideration in this report.

The a SIR for this project is 0.03. Since this value is less than 1.25, the project does not qualify for implementation under the ECIP Program.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 LCCA SUMMARY

To qualify for government funcing, ECOs must have a discounted Savings-to-Investment Ratio (SIR) greater than 1.25 and a simple payback less than 10 years. A project with an investment cost greater than $300,000 will qualify for ECIP funding. Projects with investment costs less than $300,000 will qualify for the Federal Energy Management Program (FEMP). Table 6-1 below summarizes the results of the LCCA.

Table 6-1. LCCA Results

	Upgrade Electrical Distribution System	
Description	**Existing System**	**Reduced System**
Annual Energy Savings (kWh)	222,330	16,727
Annual Cost Savings ($)	18,498	1,392
Investment Cost ($)	1,108,832	796,191
Simple Payback (yrs)	59.9	572.1
SIR	0.24	0.03

6.2 CONCLUSIONS

The conclusions discussed below are based on the results of the LCCAs performed in this study. Other relevant factors are also discussed, however, which should be considered before making a final decision.

6.2.1 Existing System (1995 to 1997)

With an SIR of 0.24, upgrading the existing electric distribution system from 2400 V to 4160 V is clearly unfeasible based upon energy savings alone. The high construction cost to implement the voltage upgrade and the low cost of power at Fort Greely both contribute to the inability to justify the conversion.

Working backwards from the results above, the average yearly cost of electricity would have to be at least $0.43 per kWh at the present construction cost, or the construction cost would have to be less than $193,000 at the present average yearly cost of electricity, in order to achieve an SIR of 1.25 or higher. It is EMC's opinion that neither of those numbers will ever be possible.

While upgrading the system voltage from 2400 V to 4160 V will not reduce the system losses enough to justify the construction costs, the conversion from an ungrounded system to a grounded system will dramatically enhance the safety and reliability of the overhead distribution system. With the ungrounded system presently in place, it is unlikely that a ground fault on a feeder will trip the feeders protective relay at Building 606 and take the feeder out of service until the fault can be removed. Approximately 85% of the faults that occur on an overhead distribution system are single-line-to-ground faults, simply referred to as ground faults.

Ground faults can be caused by tree limbs dropping onto the lines under the weight of a snowfall, or an automobile skidding into a pole and knocking it to the ground. The tree limb will lay across the lines or the lines will lay on the ground for an indefinite period of time. Eventually, someone reports the incident before the circuit is cleared by a lineman who must manually open the feeder breaker. In populated areas, not only will many people be without electricity while the line is down, but a line laying on the ground is extremely dangerous to anyone who comes into contact with it. In unpopulated areas, it could take several hours to find the downed line.

In addition, the ground fault acts as the system ground point. The ground fault current that flows through the line is the capacitive charging current of the system, generally only a few amps. If the ground fault is intermittent or allowed to continue, the entire system could be subjected to severe overvoltages which can be as high as six or eight times the phase voltage. The overvoltages are a result of the repetitive charging of the system capacitance or the resonance between the system capacitance and inductance. These overvoltages can puncture insulation and result in additional ground faults. Once the second ground fault occurs, a line-to-line fault occurs, usually arcing, with a current magnitude large enough to damage equipment. But this still may not be large enough to trip the overcurrent protective devices. Ungrounded systems are not standard practice for modern overhead distribution systems.

One final note, the protective relays on Feeder 9 will never see a ground fault on the 7200 V portion of the feeder because of the Δ-Δ step-up transformers at Building 606 and the Richardson Substation. Because of the remote location of this feeder, a line could be down and unmanned facilities without power for a long period of time before the outage is recognized.

6.2.2 Reduced System (Post 2001)

With an SIR of 0.03, upgrading the reduced electric distribution system from 2400 V to 4160 V is unjustified based upon energy savings alone. As with the existing system, the high construction cost to implement the voltage upgrade and the low cost of power at Fort Greely both contribute to the inability to justify the conversion. Even with generators 1, 2, and 3 laid away the SIR is not significantly improved.

It's not surprising that the reduced system looks even worse than the existing system because approximately 80% of the load has been eliminated. The system losses are equal to I^2R where I is the line or feeder load (current) and R is the line resistance in ohms. The system losses are much more dependent upon the line current because of its squared characteristic than the line resistance which is linearly proportional. Consequently, even though only 25% of the lines have been eliminated, the 80% reduction in load current has the predominant impact on system losses.

The average yearly cost of electricity would have to be greater and the construction cost lower than those defined above for the existing system. It is EMC's opinion that it will be almost impossible to justify upgrading the reduced system to 4160 V based upon energy savings alone. However, a case can be made for upgrading the system voltage based upon safety and reliability as described for the existing system above. Everything stated above with regard to safety and reliability for the existing system is also true for the reduced system.

6.3 RECOMMENDATIONS

EMC recommends that the Fort Greely electrical distribution system not be upgraded from an ungrounded 2400 V system to a grounded 4160 V system at this time. EMC further believes that it will always be difficult to justify this project based upon energy savings and economic considerations. With the continuing consolidation of electric utilities and open transmission access imminent, expectations are that electric rates will decrease over the long term. On the other hand, construction and equipment costs are expected to continue increasing at 3-5% a year for the near term, at least. None of this bodes well for the economic feasibility of this project in the future.

An upgrade to the electrical distribution system to a grounded, 4160 V system is justifiable on the basis of safety and reliability. An ungrounded distribution system is inappropriate at this site. At the very least, ground fault detection should be implemented as determined is previous studies.

APPENDIX A

Scope of Work and Confirmation Notices

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
P.O. BOX 898
ANCHORAGE, ALASKA 99506-0898

REPLY TO
ATTENTION OF:

AUG 14 1995

Contract Support Group

SUBJECT: Contract No. DACA01-94-D-0033, Indefinite Delivery Architect-Engineer Contract for Energy Engineering Analysis Program (EEAP), North, West, and Midwest Regions

Mr. Dennis Jones
EMC Engineers
2750 South Wadsworth Boulevard
Suite C-200
Denver, Colorado 80227-3400

Dear Mr. Jones:

The following documents are enclosed for your use to prepare a fee proposal for the work in item a:

a. A Scope of Work for a modification to Delivery Order No. 0003 entitled, "Limited Energy Study (Power Distribution), Fort Greely, Alaska," is as follows: Add the energy efficiency sutdy for steam, water, and sanitary sewer for the buildings (see active building list) that are to remain in active status.

b. Fee proposal forms.

Please furnish a fee proposal (forms enclosed) for this work by August 24, 1995, to the attention of my Contract Support Group. Hourly labor rates and overhead rates are established in the basic contract.

Please contact Mr. Randy Jacobs, Negotiator, at 907/753-5639 if you have any questions.

Sincerely,

Trillis B. Enders

Trillis B. Enders
Alternate Contracting
Officer's Representative

Enclosures

CENPA-EN-TE-DM

AUG 1995

SCOPE OF WORK

ENERGY EFFICIENCY STUDY

FOR

FORT GREELY

ALASKA

Performed as part of the

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

GENERAL SCOPE OF WORK
CONTRACT NO. DACA85-94-C-0033
Delivery Order No. 0003

ENERGY EFFICIENCY STUDY
FORT GREELY, AK
performed as part of the
ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

TABLE OF CONTENTS

ANNEXES

1.0 BRIEF DESCRIPTION OF WORK: The Architect-Engineer (A/E) shall:

1.1. Perform a limited site survey of specific buildings or areas to collect all data required to evaluate the specific ECOs included in this study.

1.2. Provide project documentation for recommended ECOs as detailed herein.

1.3. Prepare a comprehensive report to document all work performed, the results and all recommendations.

2.0 GENERAL:

2.1. This study is limited to the evaluation of the specific buildings, systems, or ECOs listed in the DETAILED SCOPES OF WORK, Annexes A and D.

2.2. The information and analysis outlined herein are considered to be minimum requirements for adequate performance of this study.

2.3. For the buildings, systems or ECOs listed in Annex A, all methods of energy conservation which are reasonable and practical shall be considered, including improvements of operational methods and procedures as well as the physical facilities. All energy conservation opportunities which produce energy or dollar savings shall be documented in this report. Any energy conservation opportunity considered infeasible shall also be documented in the report with reasons for elimination.

2.4. The study shall consider the use of all energy sources applicable to each building, system, or ECO.

2.5. The "Energy Conservation Investment Program (ECIP) Guidance", establishes criteria for ECIP projects and shall be used for performing the ecomonic analyses of all ECOs and projects. A computer program, Life Cycle Cost In Design (LCCID), has been developed for performing life cycle cost calculations in accordance with ECIP guidelines and is referenced in the ECIP Guidance. This program is available commercially from the BLAST Support Office in Urbanna, Illinois. The BLAST Support Office can be contacted at 1-800-842-5278. The latest version of the program should be used. If any program other than LCCID is proposed for life cycle cost analysis, it must use the mode of calculation specified in the ECIP Guidance. The output must be in the format of the ECIP LCCA summary sheet, and it must be submitted for approval prior to use.

2.6 Energy conservation opportunites determined to be technically and economically feasible shall be developed into projects acceptable to installation personnel. This may involve combining similar ECOs into larger packages which will qualify for ECIP or MCA funding, and determining in coordination with installation personnel the appropiate packaging and implementation approach for all feasible ECOs.

3.0 PROJECT MANAGEMENT:

3.1. Project Managers:

3.1.1 Project Manager: The A/E shall designate a project manager to serve as a point of contact and liaison for work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. This designated individual shall be responsible for coordination of work required under this contract.

3.1.2 Design Manager: The Contracting Officer will designate a design manager to serve as the Government's point of contact and liaison for all work required under this contract.

3.2. Installation Assistance: The Director of Public Works or authorized representative will designate an individual to assist the A/E in obtaining information and establishing contacts necessary to accomplish the work required under this contract.

3.3. Public Disclosures: The A/E shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.

3.4. Meetings: Meetings will be scheduled whenever requested by the A/E or the Design Manager for the resolution of questions or problems encountered in the performance of the work. The A/E's project manager and the design manager shall be required to attend and participate in all meetings pertinent to the work required under this contract. These meetings, if necessary, are in addition to the presentation and review conferences.

3.5. Site Visits, Inspections, and Investigations: The A/E shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

3.6. Conferences and Confirmation Notices:

3.6.1. The A/E shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the A/E and/or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. the A/E shall forward to the Design Manager within ten calendar days, a reproducible copy of the records.

3.6.2. The A/E shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The A/E shall forward to the Design Manager within ten calendar days, a reproducible copy of the record of request or receipt of material.

3.6.3. A review conference will be scheduled approximately 28 days after submittals. Review comments will be provided at this conference. These comments will become part of the conference minutes forwarded to the A-E and annotated with conference action. Review comments provided to the A-E will not necessarily show coordination requirements with other parts of the

submittal. The A-E shall incorporate the review comments into each part of the submittal as necessary.

3.7. Interview: The A/E shall conduct entry and exit interviews with the Director of Public Works or designated representative before starting work at the installation and after completion of the field work. The Design Manager shall schedule the interviews at least one week in advance and shall be in attendance.

3.7.1. Entry: The entry interview shall describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview shall cover the following points:

a. Schedules
b. Names of energy analysts who will be conducting the site survey.
c. Proposed working hours.
d. Support requirements from the Directorate of Public Works.

3.7.2. Exit: The exit interview shall be conducted when the field work is complete and briefly describe the items surveyed and probable areas of energy conservation.

4.0 SERVICES AND MATERIALS: All services, materials (except those specifically enumerated to be furnished by the Government), plant, labor, supervision and travel necessary to perform the work and render the data required under this contact are included in the lump sum price of the contract.

5.0 PROJECT DOCUMENTATION: All energy conservation opportunities which the A/E has considered shall be included in one of the following categories and presented in the report as such:

5.1. ECIP Projects: To qualify as an ECIP Project, an ECO, or several ECOs which have been combined, must have a construction cost estimate greater than $300,000. The overall project and each discrete part of the project shall have an SIR greater than 1.25. Projects which qualify for ECIP funding shall be identified, separately listed, and prioritized by the Saving to Investment Ratio (SIR). Programming documentation shall consist of a DD Form 1391, life cycle cost analysis (LCCA) summary sheet(s) (with necessary backup data to verify the numbers presented), and a Project Development Brochure (PDB). A life cycle cost analysis summary sheet shall be developed for each ECO and for the overall project when more than one ECO are combined. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs.

5.2. NON-ECIP Projects: Projects which do not meet ECIP criteria, but which have an SIR greater than 1.25 shall be documented and ranked in order of highest to lowest SIR. Projects or ECOs shall be provided with the following documentation: the life cycle cost analysis (LCCA) summary sheet completely filled out; a description of the work to be accomplished; backup data for the LCCA, ie; energy savings calculations and cost estimate(s); and the simple payback period. The energy savings for projects consisting of multiple ECOs must take into account there synergistic effects of the individual ECOs. In addition these projects shall have the necessary documentation prepared, as required by the Government's representative, for one of the following categories:

a. Regular Military Construction Army (MCA) Program. This program is for projects which have a total cost greater than $300,000.00 and a simple payback period of ten to twenty-five years. Documentation shall consist of DD Form 1391 and a Project Development Brochure.

b. Low Cost/No Cost Projects. These are projects which the Directorate of Public Works (DPW) can perform using its resources. Documentation shall be as required by DPW.

5.3. Nonfeasible ECOs: All ECOs which the A/E has considered but which are not feasible, shall be documented in the report with reasons and justifications showing why they were rejected.

6.0 DETAILED SCOPE OF WORK: The Detailed Scope of Work is contained in Annex A and Annex D.

7.0 WORK TO BE ACCOMPLISHED:

7.1. Review Previous Studies: Not Used.

7.2. Perform a Limited Site Survey: The A/E shall obtain all necessary data to evaluate the ECOs cr projects by conducting a site survey. The A/E shall document his site survey on forms developed for the survey, or standard forms, and submit these completed forms as part of the report. All test and/or measurement equipment shall be properly calibrate prior to its use.

7.3. Revaluate Selected Projects: Not Used.

7.4. Evaluate Selected ECOs: As described in Detailed Scope of Work.

7.5. Combine ECOs Into Recommended Projects: At the interim review conference, the A/E will be provided direction of the packaging or the combining of ECOs for programming purposes and also indicate the fiscal year for which the programming or implementation documentation shall be prepared. Some projects may be a combination of several ECO's, and others may contain only one.

7.6. Submittals: The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and shall be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. Names of the persons primarily responsible for the project shall be included.

7.6.1. Interim Submittal: An interim report shall be submitted for review after the field survey has been completed and an analysis has been performed on all of the ECOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. Calculations showing energy and dollar savings, SIR, and simple payback period of all the ECOs shall be included. The survey forms completed during this audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound separately in a

standard three-ring binder. The A/E shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. The final report and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly.

7.6.2. Final Submittal: The A/E shall prepare and submit the final report when all sections of the report are 100% complete and all comments from the interim submittal have been resolved. The A/E shall submit the Scope of Work for the study and any modifications to the scope of Work as an appendix to the submittal. The report shall contain a narrative summary of conclusions and recommendations, together with all raw and supporting data, methods used, and sources of information. The report shall integrate all aspects of the study. The recommended projects, as determined in accordance with paragraph 5, shall be presented in order of priority by SIR. The final report and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The final report shall be arranged to include:

a. An Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (See Annex B for minimum requirements).

b. The narrative report describing the problem to be studied, the approach to be used, and the results of this study.

c. Documentation for the recommended projects (includes LCCA Summary Sheets).

d. Appendices to include as a minimum:

1) Energy cost development and backup data
2) Detailed calculations
3) Cost estimates
4) Computer printouts (where applicable)
5) Scope of Work

7.7 Presentation: The A/E shall give a formal presentation of the interim submittal to the installation, command, and other Government personnel. Slides or view graphs showing the results of the study to date shall be used during the presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. The presentation will be conducted the same day as the review conference.

ANNEX A

DETAILED SCOPE OF WORK (REVISED)
CONTRACT NO. DACA85-94-D-0033
Delivery Order No. 0003

ENERGY EFFICIENCY STUDY (POWER DISTRIBUTION)
FORT GREELY, ALASKA

1.0 General Information:

1.1 The Architect-Engineer (A-E) shall furnish all services, materials, supplies, labor, equipment, investigations, studies, supervision and travel as required in connection with this Statement of Work (SOW), and all furnished and referenced instructions.

1.1.1 This SOW is organized as follows:

Paragraph TOPIC:

1.0 General Information
2.0 Project Criteria
3.0 Cost and Scope Limitations
4.0 Delivery Schedule
5.0 Architect Engineer Services
6.0 Initiation Of Work
7.0 Government Review
8.0 Travel
9.0 Submittals

1.1.3 Project Description: The AE will be required to conduct a limited site survey, evaluate energy savings, construction costs, and the cost to savings ratio associated with converting the existing power distribution system from 2400 volts, 3-wire ungrounded Delta to a 4-wire system. The AE shall investigate the existing system, and prepare a comprehensive report documenting all work performed, the results and recommendations. See Annex D for list of buildings and linear feet of utilities to remain active after base realignment.

The investigation is to include but not limited to: Insulators, crossarm condition, pole condition, wire size, wire material, wire connectors and transformers. Begin at the output of the Golden Valley Electric Association Transformed into the power plant and out through the distribution system. There are approximately 35 miles of overhead distribution system. Single line drawings of the distribution system resulting from a recent short circuit study and feeder and transformer data are at Enclosure 1.

1.1.4 Point of Contact: The Design Manager for this project is Mr. Ron Cothren and the Contracting Officer's Representative is Mr. Claude Vining and the ACOR is Mrs. Trillis Enders. The Point of Contact at Fort Greely is Mr. Mike Murphy.

2.0 Project Criteria:

2.1 Government Furnished Materials and Equipment:

a. US Army Corps of Engineers, Architectural and Engineering Instructions - Design Criteria, 9 December 1991.

b. Energy Conservation Investment Program (ECIP) Guidance, dated 10 Jan 1994.

c. TM5-785, Engineer Weather Data

d. AR 420-49, Heating, Energy Selection and Fuel Storage, Distribution, and Dispensing Systems.

e. Tri-Service Military Construction Program (MCP) Index, dated 4 January 1994.

f. MCACES-Gold cost estimating guidance, program and database, diskettes, and licensing agreement.

2.2.1 Review Previous Studies: Previous EEAP studies do not cover power distribution.

3.0 Cost and Scope Limitations:

3.1 Cost Limitation: The construction cost limitation for this project is undefined. The AE will be responsible for developing the cost based upon the scope constraints for this project.

3.2 Cost Estimate:

3.1.2 Cost Estimate Format: Cost estimates shall be prepared using the latest version of Micro Computer Aided Cost Engineering System (MCACES)-GOLD, Version 5.20J or greater, with the appropriate labor equipment and material data bases. MCACES-GOLD will be provided to the A-E by the Cost Engineering Branch of the Alaska District Corps of Engineers at no cost. Upon completion of the contract, the A-E will return all material to the Government. The Alaska District is using a Standardized Work Breakdown Structure (WBS) for all military and civil work cost estimates. Corps format for cost estimates will be made available for use on other cost estimate requirements.

4.0 Delivery Schedule: The work, other related data, and services required in accordance with the contract shall be accomplished within the limitation of projects scope. The schedule for delivery of data to the Contracting Officer is in calendar days. Calendar days for each requirement extend from the date of the Notice to Proceed (NTP) or approval for each item, except as otherwise noted.

	Item	Schedule	DeliveryReview/Conference Time/Location
(a)	Start Project: Interviews and Site Survey	30 days following NTP	Not Required
(b)	Interim Submittal	90 days following NTP	28 days / Post
(c)	Final Submittal	21 days following Interim Rev. Conf.	Not required

5.0 Architect-Engineer Services:

5.1 Interim Submittal: The interim submittal shall fulfill the requirements of the paragraph 7.6.1 of the General Scope of Work.

5.2 Final Submittal: The final submittal shall fulfill the requirements of paragraph of the General Scope of Work. The A-E shall incorporate all interim review conference comments. The Government may back-check all documents which comprise this submittal. The documents, if found incomplete, shall be returned to the A-E for further work which shall be performed at no additional cost to the Government.

6.0 Initiation of Work:

The AE shall not proceed nor initiate any work nor any succeeding design level of the work required under this SOW prior to receipt of award. Any work done without being directed to do so by the Contracting Officer/authorized representative shall be at the AE's own risk.

7.0 Government Review:

7.1 Value Engineering: Not Used.

7.2 Review: The Contracting Officer or his authorized representative may furnish the AE review comments on the data submitted. The AE shall incorporate all accepted review comments in the development of data for the next submittal. The AE will not be required to incorporate comments that may be categorized as "designer preference." If any review comment requires clarification and/or amplification to assure compliance, the AE shall notify the Contracting Officer or his authorized representative in writing.

8.0 Travel:

Out of town travel is anticipated to Fort Greely at Delta Junction, Alaska.

9.0 Submittals:

All submittals shall be received at the Alaska District Engineer Offices, Design Management Section, Military Technical Engineering Branch in accordance with the design schedule in Section 4.0 above.

9.1 A dated submittal letter shall be provided with each submittal to the Contracting Officer with distribution to agencies listed. This letter shall indicate to whom and the number of copies to be mailed to the agencies listed via overnight, hand, or telefax delivery service by the AE.

9.2 The A/E shall make direct distribution of correspondence, minutes, report submittals, and responses to comments as indicated by the following schedule:

AGENCY	EXECUTIVE SUMMARIES	REPORTS	CORRESPONDENCE	FIELD NOTES
Commander, 6th Infantry Division (Light) ATTN: APVR-FG-PW (Murphy) P.O. Box 1289, Delta Junction, AK 99737	7	7	1	1*
Commander, 6th Infantry Division (Light) ATTN: APVR-PW-O (Berg) Building 730, Fort Richardson, AK 99505-5500	3	3	1	-
Commander, USAED, Mobile ATTN: CESAM-EN-DM (Battaglia) P.O. Box 2288, Mobile, AL 36628-0001	1	1	1	-
Commander, USAED, Alaska ATTN: CENPA-EN-TE-DM (Piening) P.O. Box 898, Anchorage, AK 99506-0898	7	7	7	1*
Commander, USAED, Alaska ATTN: CENPA-C0-FR (Shuman) P.O. Box 35066, Fort Wainwright, AK 99703-0066	1	1	1	-
Commander, North Pacific Division ATTN: CENPD-PE-TE (Pinkham) P.O. Box 2870, Portland, OR 97208-2870	1	1	-	-
Commander, US Army Logistics Evaluation Agency ATTN: LOEA-PL (Mr. Keath) New Cumberland Army Depot New Cumberland, PA 17070-5007	1	-	-	-
Commander, US Army Corps of Engineers ATTN: CEMP-ET (Mr. Gentil) 20 Massachussetts Avenue, NW Washington, DC 20314-1000	1	-	-	-

* Field Notes Submitted in final form at interim submittal

PIENING\re\x1600\ARMY\FTW141\DAVE
4 Aug 94

ANNEX B

EXECUTIVE SUMMARY GUIDELINE

1. Introduction.

2. Building Data (types, number of similar buildings, sizes, etc.)

3. Present Energy Consumption of Buildings or Systems Studied.

   - Total Annual Energy Used.

   - Site Energy Consumption.

     Electricity - KWH, Dollars, BTU
     Fuel Oil - GALS, Dollars, BTU
     Natural Gas - THERMS, Dollars, BTU
     Propane - GALS, Dollars, BTU
     Other - QTY, Dollars, BTU

4. Energy Conservation Analysis.

   - ECOs Investigated.
   - ECOs Recommended.
   - ECOs Rejected. (Provide economics or reasons).
   - ECIP Projects Developed. (Provide list)*
   - Non-ECIP Projects Developed. (Provide list)*
   - Operational or Policy Change Recommendations.

* Include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date.

5. Energy and Cost Savings.

   - Total Potential Energy and Cost Savings resulting from recommended projects in MBTU/yr and $K/yr.

   - Percentage of Energy Conserved

   - Energy Use and Cost Before and After the Energy Conservation Opportunities are Implemented.

ANNEX C

REQUIRED DD FORM 1391 DATA

To facilitate ECIP project approval, the following supplemental data shall be provided:

a. In title block clearly identify projects as "ECIP."

b. Complete description of each item of work to be accomplished including quantity, square footage, etc.

c. A comprehensive list of buildings, zones, or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.).

d. List references, and assumption, and provide calculations to support dollar and energy savings, and indicate any added costs.

(1) If a specific building, zone, or area is used for sample calculations, identify building, zone or area, category, orientation, square footage, floor area, window and wall area for each exposure.

(2) Identify weather data source.

(3) Identify infiltration assumptions before and after improvements.

(4) Include source of expertise and demonstrate savings claimed. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.

e. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operations and future expected efficiency. if full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of the complete existing installation is required to make accurate determinations of required retrofit actions.

f. AN ECIP life cycle cost analysis summary sheet as shown in the ECIP Guidance shall be provided for the complete project and for each discrete part included in the project. The SIR is applicable to all segments of the project. Supporting documentation consisting of basic engineering and economic calculations showing how savings were determined shall be included.

g. The DD Form 1391 face sheet shall include, for the complete project, the annual dollar and MBTU savings, SIR, simple amortization period and a statement

attesting that all buildings and retrofit actions will be in active use throughout the amortization period.

h. The calendar year in which the cost was calculated shall be clearly shown on the DD Form 1391.

i. For each temporary building included in a project, separate documentation is required showing (1) a minimum 10-year continuing need, based on the installation's annual real property utilization survey, for active building retention after retrofit, (2) the specific retrofit action applicable and 93) an economic analysis supporting the specific retrofit.

j. Nonappropriated funded facilities will not be included in an ECIP project without an accompanying statement certifying that utility costs are not reimbursable.

k. Any requirements required by ECIp guidance dated 4 Nov 1992 and any revisions thereto. Note that unescalated costs/savings are to be used in the economic analyses.

l. The five digit category number for all ECIP projects except for Family Housing is 80000. The category code number for Family Housing projects is 71100.

ANNEX D

DETAILED SCOPE OF WORK (REVISED)
CONTRACT NO. DACA85-94-D-0033
Delivery Order No. 0003

ENERGY EFFICIENCY STUDY (STEAM, WATER, SANITARY SEWER)
FORT GREELY, ALASKA

1.0 GENERAL INFORMATION

1.1 The Architect-Engineer (AE) shall furnish all services, materials, supplies, labor, equipment, investigations, studies, supervision and travel as required in connection with this Statement of Work (SOW), and all furnished and referenced instructions.

1.1.1 <u>This SOW is organized as follows</u>:

<u>Paragraph TOPIC</u>:

1.0 General Information
2.0 Project Criteria
3.0 Initiation Of Work
4.0 Government Review
5.0 Travel
6.0 Schedule and Submittal Requirements
7.0 Payment Schedule

1.1.2 <u>Project Description</u>: The purpose of the Energy Efficiency Study is to identify modifications necessary to provide the most energy efficient configuration of utilities to serve the designated active buildings at Fort Greely following implementation of the base realignment plan. Currently the buildings at Fort Greely are served by a central electric distribution system, central steam system, central potable water system, and a central sewer system. Much of these central systems are near the end of their useful lives. With the abandoning of most buildings, the existing utilities will likely be grossly over sized and operate with poor energy efficiency and high maintenance costs. This study is to evaluate the following configurations for each utility:

a. Modification of central systems to serve remaining designated active buildings.

b. Installation of separate utilities to serve each designated active building or group of buildings.

The contractor will be required to evaluate the central steam, potable water, and sanitary sewer systems and determine if the systems are adequate to serve the buildings and associated utilidors designated in the Fort Greely Realignment Plan (see Active Building List below) that are to remain active. In evaluating the present system, the contractor shall complete a energy survey and provide a plan that will provide the greatest energy efficiency.

There are currently 231 buildings located on Fort Greely, consisting of 1,699,787 sq. ft. of space. the majority of which will be "laid-away" under the Layaway Program for disposition or eventual demolition. Of these 231 buildings, the tollowing have been identified for retention to support the residual force to be left at Fort Greely. The following tables are from a draft of the IMPLEMENTATION PLAN FOR REALIGNMENT OF FORT GREELY as provided by Mr. Mike Murphy, Dept. of Public Works, Ft. Greely, Alaska:

Permanent Active Facility List as of 25 JUL 95

Bldg No.	Description	Location	Size (SF)
110	POL Monitoring	North Post	382
501	HQ	Cantonment	19,095
504	Fire Station	Cantonment	6,192
605	Consolidated PW	Cantonment	24,915
606	Central Heat Plant	Cantonment	30,334
607	Heat Plant Annex	Cantonment	999
615	Roads and Grounds	Cantonment	17,351
617	POL Operation	Cantonment	448
618	POL Operation	Cantonment	621
633	Sewage Treatment	Cantonment	2,784
638	Sewage Lagoon	Cantonment	742
639	Contact Chamber	Cantonment	696
820	Unacc Pers Hsg	Cantonment	16,175
821	Unacc Pers Hsg	Cantonment	16,175
503	Gym w/o Pool	Cantonment	22,430
725	State School	Cantonment	0 (Non-Army)
1928 & 1930	CRTA Complex	Bolio Lake	35,061
2013, 2019, 2026	NWTC Complex	Black Rapids	39,218
1600, 1605, 1606	Range	Texas Range	6,211
1343, 1350, 1352	Range	Beales Range	4,968
1419	Range	Mississippi Range	960
		TOTAL	**245,937**

Real Property Utilities

Category	Before	After
Overhead Electric	31.2 Miles	23.1 Miles
Underground Electric	10.7 Miles	3.4 Miles
Steam/Condensate Lines	57,000 LF	5,700 LF
Water Lines	40,000 LF	5,700 LF
Sewer Lines	45,000 LF	7,700 LF
Utilidors	17,600 LF	5,550 LF

1.1.3 Points of Contact: The Design Manager for this project is Mr. Ron Cothren and the Contracting Officer's Representative is Mr. Claude Vining and the ACOR is Mrs. Trillis Enders. The Point of Contact at Fort Greely is Mr. Mike Murphy.

2.0 PROJECT CRITERIA

2.1 Government Furnished Materials and Equipment:

a. US Army Corps of Engineers, Architectural and Engineering Instructions - Design Criteria, 9 December 1991.
b. Energy Conservation Investment Program (ECIP) Guidance, dated 10 Jan 1994.
c. TM5-785, Engineer Weather Data
d. AR 420-49, Heating, Energy Selection and Fuel Storage, Distribution, and Dispensing Systems.
e. Tri-Service Military Construction Program (MCP) Index, dated 4 January 1994.
f. MCACES-Gold cost estimating guidance, program and database, diskettes, and licensing agreement.

2.2 Field Investigation

Conduct a survey of the existing central utilities and the buildings to remain under the Fort Greely realignment plan. Data collected for each utility should include, but not be limited to the following:

a. Present condition and expected life of the existing central distribution systems.
b. Modifications necessary to restrict central utility service only to designated active building and facilities.
c. Data necessary to determine costs associated with continued operation of central utility systems including modification costs, energy costs, and operating and maintenance (O & M) costs.
d. Data necessary to determine utility capacity requirements and energy consumption of each designated active building.
e. Modifications necessary to install separate utilities in individual buildings or groups of buildings.

2.3 Analysis

a. Operation of existing central systems with only those essential modifications required to serve the remaining designated active buildings. This option will serve as the baseline for Energy Conservation Oportunity (ECO) analysis.

b. ECO 1: Operation of existing central systems optimized to serve the remaining designated active buildings.

c. ECO 2: Installation of separate utilities (where practical) to serve each designated active building or group of buildings.

The A/E should identify the logical configuration of each utility for each of the above options and perform life cycle cost analysis (LCCA) including capital costs of required modifications, energy costs, and O & M costs.

Economic analysis should follow the criteria for the "Energy Conservation Program (ECIP) Guidance", described in letter from DAIM-FDF-U, dated 10 Jan 1994.

Computer modeling will be used to determine the annual energy costs for typical buildings. The results of these calculations may be applied to buildings which are similar to the typical buildings. To be considered similar, a building must have the same type of occupancy schedule, the same type of HVAC system, and the same type of construction. Modeling will be performed using a professionally recognized and proven computer program of programs that integrate architectural features with air-conditioning, heating, lighting,, and other energy-producing or consuming systems. These programs will be capable of simulating the features, systems, and thermal loads of the building under study. The simulation programs acceptable for use in this study are listed below. Any substitutes must be submitted and approved by the COR.

A. Building Loads and System Thermodynamics (BLAST).
B. DOE 2.1d
C. Carrier E20 of Hourly Analysis Program (HAP)
D. Trane Air-Conditioning Economics (TRACE).
E. Beacon

3.0 INITIATION OF WORK

The AE shall not proceed nor initiate any work nor any succeeding design level of the work required under this SOW prior to receipt of award. Any work done without being directed to do so by the Contracting Officer/authorized representative shall be at the AE's own risk.

4.0 GOVERNMENT REVIEW:

4.1 Value Engineering: Not Used.

4.2 Review: The Contracting Officer or his authorized representative may furnish the AE review comments on the data submitted. The AE shall incorporate all accepted review comments in the development of data for the next submittal. The AE will not be required to incorporate comments that may be categorized as "designer preference." If any review comment requires clarification and/or amplification to assure compliance, the AE shall notify the Contracting Officer or his authorized representative in writing.

5.0 TRAVEL

Out of town travel is anticipated to Fort Greely at Delta Junction, Alaska.

6.0 SCHEDULE AND SUBMITTAL REQUIREMENTS

Submittal	Schedule
Pre-Final Report	120 days from NTP
Review Conference	30 days after Pre-Final submittal
Final Report	30 days from review conference

6.1 A dated submittal letter shall be provided with each submittal to the Contracting Officer with distribution to agencies listed. This letter shall indicate to whom and the number of copies to be mailed to the agencies listed via overnight, hand, or telefax delivery service by the AE.

6.2 The A/E shall make direct distribution of correspondence, minutes, report submittals, and responses to comments as indicated by the following schedule:

AGENCY	EXECUTIVE SUMMARIES	REPORTS	CORRESPONDENCE	FIELD NOTES
Commander, 6th Infantry Division (Light) ATTN: APVR-FG-PW (Murphy) P.O. Box 1289, Delta Junction, AK 99737	7	7	1	1*
Commander, 6th Infantry Division (Light) ATTN: APVR-PW-O (Berg) Building 730, Fort Richardson, AK 99505-5500	3	3	1	-
Commander, USAED, Mobile ATTN: CESAM-EN-DM (Battaglia) P.O. Box 2288, Mobile, AL 36628-0001	1	1	1	-
Commander, USAED, Alaska ATTN: CENPA-EN-TE-DM (Piening) P.O. Box 898, Anchorage, AK 99506-0898	7	7	7	1*
Commander, USAED, Alaska ATTN: CENPA-C0-FR (Shuman) P.O. Box 35066, Fort Wainwright, AK 99703-0066	1	1	1	-
Commander, North Pacific Division ATTN: CENPD-PE-TE (Pinkham) P.O. Box 2870, Portland, OR 97208-2870	1	1	-	-
Commander, US Army Logistics Evaluation Agency ATTN: LOEA-PL (Mr. Keath) New Cumberland Army Depot New Cumberland, PA 17070-5007	1	-	-	-
Commander, US Army Corps of Engineers ATTN: CEMP-ET (Mr. Gentil) 20 Massachussetts Avenue, NW Washington, DC 20314-1000	1	-	-	-

* Field Notes submitted in Final Form at interim submittal

PIENING\re\x1600\ARMY\FTG058\ANNEXD.FTG 2 Aug 95

ESTIMATE OF ARCHITECT ENGINEER PROFESSIONAL SERVICES

Date__________19_____

☐ Revised ☐ Original

ject:____ Location:________________

stimated by:_____________________________________ Sheets of Drawing Required:_______

____CONTRACT NO: DO/MOD NO: ______________________

REMARKS:

Item a. Direct Labor Costs	Hours	Rate	Total
DISCIPLINE			
BTOTALS			

TOTAL DIRECT COST $____________

Item b. Overhead charge applicable to direct labor, ________ % of Item a. $____________

Item c. General and Administrative Overhead, ________ % of Item a. $____________

Item d. Materials and incidental reproduction:

____

____ $____________

Item f. Profit ________ % of subtotal of Items a, b, c, d, and e. (attach profit computations)

____

____ $____________

Item g. Subcontracts for this contract (attach breakdown for each subcontract):

ARCH________ STRUC________ ELEC________

CIVIL________ MECH________ OTHER________ SUBTOTAL $____________

________ % Profit on subcontracts $____________

Item h. Travel expenses: (No labor - EXPLAIN)

PER DIEM:________ man days at $________ PER DAY $____________

GR TRANS:________ days at $________ PER DAY $____________

AIR FARE:________ rd trips at $________ PER ROUND TRIP $____________

PER DIEM:________ rd trips at $________ PER ROUND TRIP $____________

(round to the nearest dollar) TOTAL FEE $____________

/E SIGNATURE_________________________________ DATE________________________

TLE_________________________________

AEESTFRM.DOC

PROFIT EVALUATION SHEET
Weighted Guideline Method
RFP/Contract No. ________________
Modification/DO No.________

Factor	Rate	Weight	Value
Degree of Risk	25	______	______
Relative Difficulty of Work	20	______	______
Size of Job	15	______	______
Period of Performance	20	______	______
Contractor's Investment	5	______	______
Assistance by Government	5	______	______
Subcontracting	10	______	______
TOTAL	100%	PROFIT	______

Explanation of Weight Assigned--

Degree of Risk:____

Relative Difficulty of Work:________________________________

Size of Job:____

Period of Performance:___________________________________

Contractor's Investment:_________________________________

Assistance by Government:________________________________

Subcontracting:____

NPA Form 13
2267S/Dec 92

Previous Editions Obsolete

Based on the circumstances of the procurement action, each of the above factors shall be weighted from .07 to .15 as indicated below. "Value" shall be obtained by multiplying the rate by the weight. The Value column when totaled indicates the fair and reasonable profit percentage under the circumstances of the particular procurement.

Degree of Risk: Where the work involves no risk or the degree of risk is very small, the weighting should be .07; as the degree of risk increases, the weighting should be increased up to a maximum of .15. For construction work, lump sum items shall generally have a higher weight than unit price items; other things to consider include the nature of the work and where it is to be performed, etc. AE contracts with options shall generally have a higher weighted value than contracts without options; other things to consider include nature of design, responsibility for design, amount of principal time required, etc. For all types of contracts consider the portion of the work to be done by subcontractors, amount and type of labor included in costs, whether the negotiation is before or after performance of the work, etc. Modifications settled before the fact have much greater risk than those settled after the fact. A weight of .07 is appropriate for after the fact equitable adjustments and/or settlements.

Relative Difficulty of Design: If the design is most difficult and complex the weighting should be .15 and should be proportionately reduced to .07 on the simplest of jobs. This factor is tied-in to some extent with the degree of risk. Some things to consider are: the nature of the design, by whom it is to be done, i.e. subcontractor, consultants, what is the schedule, etc., and it is rehab or new work.

Size of Job: All work and fees not in excess of $50,000 shall be weighted at .15. Work estimated between $50,000 and $500,000 shall be proportionately weighted from .15 to .09. Work from $500,000 to $1,000,000 shall be proportionately weighted from .09 to .07. Work in excess of $1,000,000 shall be weighted at .07. It should be noted that control of fixed expenses generally improves with increased job magnitude.

Period of Performance: Work in excess of 24 months (180 days actual time) are to be weighted at .15. Work of lesser duration shall be proportionately weighted from .07 to .15 for work not exceeding 60 days.

Contractor's Investment: To be weighted from .07 to .15 on the basis of below average, average, and above average. Things to consider include amount of subcontracting, Government-furnished property or data such as surveys, soil tests, method of making progress payments, etc.

Assistance by Government: To be weighted from .15 to .07 on the basis of average to above average. For construction consider use of Government-owned property, equipment and facilities, expediting assistance, etc. For AEs consider use of as-built drawings, Government surveys, soil exploration, and foundation recommendations.

Subcontracting: To be weighted inversely proportional to the amount of subcontracting. Where 80% or more of the work is to be subcontracting use .07. The weighting should be increased proportionately to .15 where all the work is performed by the contractor's own forces.

EMC ENGINEERS, INC.

2750 South Wadsworth Blvd. • Suite C-200
Denver, Colorado 80227-3400
303/988-2951 • Fax: 303/985-2527

CONFIRMATION NOTICE

Confirmation Notice No. 1 EMC #1406.003

DATE:	11 September 1995
PLACED TO:	Dennis Jones / Fred Jones
RECEIVED FM:	Dave Piening / Gary Creviston
REPRESENTING:	U.S. Army, COE, Alaska District
PHONE:	907/753-5609
PROJECT:	Energy Efficiency Study, Ft. Greely, AK
CONTRACT NO.:	DACA01-94-D-0033, Delivery Order No. 003
NOTES PREPARED BY:	Fred Jones, E M C Engineers, Inc.
TIME & DATE OF TELECON:	10:30 MST 11 September 1995
SUBJECT:	Clarifications to SOW dated 1 August 1995

The following is a summary of the items discussed, the comments made, and the decisions made during the telephone conversation.

1. EMC will submit a combined report that includes the Energy Efficiency Studies for the Power, Steam, Water, and Sanitary Sewer Distribution Systems.

2. EMC will proceed with the study using the list of buildings to remain active as provided in the SOW dated 1 August 1995. If this list is changed significantly before the completion of the report and the results of the study are impacted, a change in the SOW will be issued.

3. EMC will use the distribution list from the original SOW dated 1 August 1994. Commander Pinkham will receive one copy of the report.

4. EMC will provide 23 copies each of the Pre-Final and Final reports.

5. EMC will address the fact that the base will not begin downsizing until 1997 and the downsizing will continue through 2000. The interim period between 1995 and 1997 will be discussed in the power distribution section of the study.

6. EMC will include the cost of having GVEA provide electric service to the buildings that will remain after the downsizing.

7. The submittal schedule will be the same as shown in Section 6.0, Page D-4 of the SOW dated 1 August 1995. For the sake of clarity, that schedule is as follows:

Submittal	Schedule
Pre-Final Report	120 days from NTP
Review Conference	30 days after Pre-Final Submittal
Final Report	30 days from review conference

/oic

Action Required: Issue Notice to Proceed.

cc: Dennis Jones
File

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.

EMC
ENGINEERS, INC.

2750 South Wadsworth Blvd. • Suite C-200
Denver, Colorado 80227-3400
303/988-2951 • Fax: 303/985-2527

CONFIRMATION NOTICE

Confirmation Notice No. 2 EMC #1406.003

DATE:	12 September 1995
PLACED TO:	Dennis Jones
RECEIVED FM:	Dave Piening
REPRESENTING:	U.S. Army, COE, Alaska District
PHONE:	907/753-5609
PROJECT:	Energy Efficiency Study, Ft. Greely, AK
CONTRACT NO.:	DACA01-94-D-0033, Delivery Order No. 003
NOTES PREPARED BY:	Fred Jones, E M C Engineers, Inc.
TIME & DATE OF TELECON:	16:45 MST 12 September 1995
SUBJECT:	Clarifications to Confirmation Notice No. 1

The following is a summary of the items discussed, the comments made, and the decisions made during the telephone conversation.

1. EMC will submit two separate reports for the Energy Efficiency Study for Fort Greely Alaska. One report will be entitled "Energy Efficiency Study (Power Distribution), Fort Greely, Alaska. The other report will be entitled "Energy Efficiency Study (Steam, Water, Sanitary Sewer), Fort Greely, Alaska.

/oic

Action Required: Issue Notice to Proceed.

cc: Dennis Jones
Bill Center
File

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.

EMC ENGINEERS, INC.

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Denver, Colorado 80227-3400
303/988-2951 • Fax: 303/985-2527

CONFIRMATION NOTICE

Confirmation Notice No. 3 EMC #1406.003

DATE:	8 December 1995
PLACED TO:	Dave Piening
RECEIVED FM:	Fred Jones
REPRESENTING:	U.S. Army, COE, Alaska District
PHONE:	907/753-5609
PROJECT:	Energy Efficiency Study, Ft. Greely, AK
CONTRACT NO.:	DACA01-94-D-0033, Delivery Order No. 003
NOTES PREPARED BY:	Fred Jones, E M C Engineers, Inc.
TIME & DATE OF TELECON:	Approximately 11:00 MST 6 December 1995
SUBJECT:	GVEA Letter

The following is a summary of the items discussed, the comments made, and the decisions made during the telephone conversation.

1. The letter to GVEA prepared by EMC for the purpose of ascertaining their interest in supplying electricity directly to the remaining buildings at Fort Greely after the realignment, has been forwarded to the appropriate contracts people for disposition. It is likely that an answer on this issue will not be back before the power distribution report submittal is due. If that is the case, the issue will be mentioned in the report only to the extent that it is another avenue that is being investigated.

2. It has not been determined yet whether the review meeting will be held in Delta Junction or Anchorage. Will confirm later.

/oic

Action Required: Issue Notice to Proceed.

cc: Fred Jones
Dennis Jones

Doug Gray
File

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.

APPENDIX B

Field Survey Notes

Recorded 8/25 - 9/1 of 1995 in Alaska 1/9

Tape recorded notes from Ft. Greely, AK

I. CRTA - Bolio Lake - Bldg 1928

overhead service to east (back of building)

A far South end 3ϕ service drop
7200 V Δ - 150 KVA, 3ϕ (1ϕ transformers)

B. behind Bldg 1928
7200 V Δ - 208/120 Y, 500 KVA, pad mount
4.5% Z @ 500 KVA, 65°C Rise, 9/89
S.N. 890133-A1, OA, 3ϕ, 60 cy
Alum. windings, NLTC -
A 7560 +5%
B 7380 +2½%
C 7200 0
D 7020 -2½%
E 6840 -5%
non PCB oil
± PSI 7 170 Gal-oil - 1275 lbs
core - 1730 lbs - coil
Tank & Fittings - 1450 lbs
4455 lbs total
Xo on Secondary
Secondary cable size -
3 [(4-750MCM, Cu, XHHW) 4"C]

C for north end 3-50 KVA - 1 ϕ transformers

D 120/208, 1600 A main switchgear
3 ϕ, 4 wire at Balio Lakes (CRTA)
Plant code 49 main bldg.
Cat No - 0894929-A
Drawing No →
Sq. D QED Power Style Switchboard
2000 A frame MCB 40°C Series 4
PAF 2036 240 - 65K AIC
SQ. D 480 - 50K AIC
600 - 42K AIC
IEC 157-1 P1 - 50 HZ
Sq D certified 50K 380/220
50K 415/240

Type PAL 600 V. for 1 ϕ use outside ~~[illegible]~~ poles only
Cat # PAM 02 PA, PH, PC, PE circuit breakers
Breaker and switches use

feeds a distribution panelboard section
panelboard feeds MCC & Lighting Panels

couldn't get in to padmount transformer
primary

the line behind the facilities continues
on north to ranges

E. Ranges are shooting ranges
O.H. lines to ranges & OP's the same
Single 8' crossarm w/ridge pin
design for the most part

F. Tap at Bolio Lake line to Texas Range & Miss. Range
Air Switch - Load Break
AB Chance, Type D
Cat. # CD7HE1CL
110 KV BIL, 15KV Class
600 A Continuous
40 KA Momentary
ID# 90320
This is the type of sectionalizer switch they use

G. OP7A - Single Phase
for heaters & lights mostly

H. Texas Range - about the same
as Mississippi Range
This is the end of the feeder line.

I. 2400 to 7200 step up transformers at
the Power Plant - (3) 1Φ, Oil filled,
500 KVA each, 7200/12470 - 2400/4160
Z = 4.55% A
Z = 4.60% B
Z = 4.55% C
55°C Temp Rise
Westinghouse
NLTC, Class OA, Subtractive Polarity

Serial NO's

C - 6407187
B - 6407186
A - 6407185

J. 2400-7200 Transformers @
Richardson Sub. (3) 1φ G.E. SpiraCore
~~2400-7200~~

4.7% Z	8991102	200 KVA
4.7% Z	8991101	200 KVA
4.7% Z	8991100	200 KVA

2300V rated

NLTC's	Pos.
6930	1
6765	2
6600	3
6435	4
6270	5

Continuous 55°C Rise
Type HS
Additive Polarity

Oil Circuit Breaker
Allis Chalmers Type OX-18
Ser NO. 305756
600 A, 7.2KV, 75KV BIL
12/55 Manufacture

K. 7200 V. O.H. line out of Richardson Sub
is (3) #4 ACSR

1 ϕ tap toward Arkansas Range
is (2) #6 Solid Copper
2400 V insulators, 4' Arms
Poles falling over, need to be
replaced and also bad shape

L. 7200 V line to RD Complex down
the hill - poles in good shape
crossarms & insulators need to be
checked & replaced

M. Fiberglass arms O.H. to Georgia
Range - could go vertical
check say - 35' poles to the
ranges - pretty low for transformer
installation - secondary will be very
low

N Chance Fiberglass Arms - narrow
profile - rating?

O. 7200 V line from front of base
on down to Balio Lakes 35/2
35' is kind of low for secondary
and getting across the highways

P. Standard O.H. Sizes
4/0 ACSR - around base where loads are heavier
#2 ACSR - on long runs where loads density is not quite so large

Q. Tap to Beales Range Complex recently taken out of service
#2 CU - 7200 V - 3ϕ

R. Lampkin Range is abandoned

S. Line from Richardson Highway to Bolio Lake is believed to be 7200 V. glass insulators #2 ACSR & #2 ACSR both sides - poles, glass and crossarms are all in pretty good shape - only 20 years old from air-break switch at Richardson Highway to Bolio Lake.

T. Mention improved Operation & Maintenance procedures by going to a grounded Y from a Δ - try to put some monetary value on this to help justify it. Also address safety as a consideration.

U. Most damage to insulators is due to damage by shot from shotguns - bird hunting

V. U.G. from Bolio Lakes line to Condos should be rebuilt - it was buried too shallow and is heaved above the ground very often - it has been patched a lot. Should be replaced by O.H. if load at Condos is still necessary and required. - patched as much as 30 times already

W. Because of the reduction in base load, you could probably reduce 9 feeders to 2 feeders

X. Line (7200) from air break switches to Mississippy Range was built by the Army - the crossarms are very low - it should be raised and the neutral put 36" - 40" down on the pole - insulators look like 5KV - small skirt - should be upgraded to 15KV class

Y. All O.H. on the base proper is 4/0 ACSR 8' crossarms - 2 phases on one side and

one phase on the other - the most efficient way to add the neutral is to put it on the side of the arm with only one phase on it presently You will need an insulator only

2. Appraximately 15% of the insulators need to be replaced and appraximatley 5% of the crossarms.

AA EG 1 1250 KVA
2400 V, 3ϕ
Amps = 300.7
50°C Rise Stator
60°C Rise Rotor
1000 KW, 360 RPM
0.8 PF, 60 Hz
101 Amps - 125 Volts - Exciter
Ser. No 3S-9691
Elliott Co., Ridgway, Pa

EG 2

Same as EG 1
Ser. No. 2-S-9691
What is rated voltage of armature - 2400V.

EG 3 Same as EG 1.
Ser No. 1-S-9691

9/9

EG 4 1563 KVA
4160 V, 3 ϕ
217 Amps
60°C Rise Stator
60°C Rise Rotor
1250 KW, 360 RPM
0.8 PF, 60 Hz
125 Amps, 125 Volts - Exciter
Ser No 4-S-10915
Elliott Company
Ridgway, PA
4160 Y
2400 Δ
connected Δ presently

EG 5 Same as EG 4
Ser No. 7-S-10915

AB Call Elliott get reactance information

$X_d'' = 26.4\%$ from power plant files
$X_d' =$
$X_s =$

E M C ENGINEERS, INC.

2750 S. Wadsworth Blvd.
Suite C-200
Denver, CO 80227
(303) 988-2951

9755 Dogwood Rd.
Suite 220
Roswell, GA 30075
(404) 642-1864

JOB
SHEET NO. OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE

Meeting - Kickoff - Ft. Greely

Name	Company Position	Phone NO.
BILL CENTER	EMC Engineers	404-642-1864
Hawley ZAchgo	Lineman	907-873-4494
LARRY Shetler	Lineman	907-873-4494
James Mellott	Director	907-873-4582
MIKE MURPHY MB	GENERAL ENGINEER	873-1132
DEAN STumpe MB	Acting Operation + Mnt	873-4589
MIKE MANDUAK		873-1145
THOMAS THEISEN	EH+PP op from DPW	873-4700
GEORGE PURSLEY 606	CHEPP util From DPW	873 4700
Fred Jones	EMC Engineers	303-988-2951

Notes: Friday Bldg 603 1/3

Kickoff Meeting 8-25-95 Public Works

10:00AM - 11:30 AM Conference Room

1. 7200 V is using Δ stepped up from 2400 V, Δ, 3φ

2. base is quite spread out some fed from 7200 V, Δ, 3φ

3. some locations have prime power

Bolio Lake
Black Rapids Training Site

buildings closed will not be abandoned city may pick up the buildings or some of them

utilidors - underground utility tunnels

majority of overhead system is in good condition
George Range need work

direct burial or underground

feeders to OP's needs to be redone (underground)
Air Force wants to spend a chunk of money to replace some power distribution.
some are metered & not read or out of calibration

realignment about 6 years out
2001 - final alignment
phased in between July 1997 and 2001

cannot completely lay away a facility
here in Alaska - it will be destroyed
in 2 years

break study into 2 time frames
1. near future - 1996 & 1997 - before
base is reduced
2. distant future - 1997-2001 - while
base is being reduced
3. after 2001 - after reduction complete

~78 vacant quarters
337 total quarters

main switchgear 1953 generation
Westinghouse & G.E. - air breakers
Magneblast
upgrade to vacuum breakers?

GVEA is radial - 25 KV to base

Carpenter Ants - a pole problem
no ice on lines; just frost

the new stuff is 15KV glass
no tracking
no flashovers

go to new switch gear - vacuum to interrupt
faults safely - new sub. for gens.
5.5 MW of generators diesel

2 - 1250's
3 - 1000's

need bkup at ranges

all buildings on list of 21 are
presently occupied

runway lights are GVEA through FAA

606 - heating plant - switchgear & gens
603 - Public Works Offices
601 - Warehouse
663 - Billetting / Housing
801 - Transient Quarters 873-6227
Room # 227 Fred
Room # 220 BILL

X_d'' for 1000 KW & 1250 KW generators is 26.4%

GVEA
758 Illinois St
Fairbanks, AK 99701

P.O. Box 71249
Fairbanks, AK 99707 } Send correspond

Dave Johnson
New Service Coordinator
1-800-770-4832 EXT. 606
1-907-452-1151

Take Cushman St. from Airport Way across the Chena River. It turns into Lincoln St.. GVEA is just down the Street on the left

Friday 9-1-95 - Public Works

1. O.H. distribution is unacceptable to GVEA as it is as Δ - going to 4160 Y makes the system more attractive to GVEA
2. Check with GVEA - find out if they would serve the base - how would they do it - would would they charge to do it.
3. Mike Mandalak 873-1145
   Mike Murphy 873-1132
   FAX 837-1384

   Director of Public Works
   P.O. Box 1289
   Delta Junction, AK 99737
   } fastest. mail.

Meeting with Hawley - Wed. 8/30/95 10-11:30

They always replace insulators & other equip with 15KV class when they do it.

---

cedar poles get rot but basically poles don't rot at the butts

---

look at (3) transformers that go 2400Δ to 7200 Δ - find out

---

substation behind power plant 2400 → 7200 for feeder 9 could use same unit

---

Standardized to REA standards for pole line design

---

typically use #2 CU 15KV cable for UG circuits

Y or Δ primary on transformers can be switched between the two from the outside

---

boost 7200 to 12.47KV also since the transformers (2400 - 7200) have to be changed out

---

ground - 4 poles/mile

They use REA 50-3 standards for O.H. design-

Notes from driving around base with Hawley 8-30-95 kwd

most damage due to being hit by snowplows

replace about 10 % of arms
" " 50 % of glass
add a new pin & glass 100 %

take an outage to pull in neutral
cable - 4-8 hours
1. do all lines first
2. do transformers second - a feeder at
a time - take outage only for pull new lines
single phase can - switch from in (neutral)
one phase to neutral
three phase cans - rewire completely

3. need two banks for a while
2400 Δ 3 4160 YGRD

4. remove series street light circuit
that still remains to install
neutral - series street lighting gone

5. replace fiberglass tie arms with
new crossarm where necessary

6. Most difficult area - right in front of
power plant due to congestion

7. all 3ϕ padmount will have to be changed out
completely

8. change 3 ~~[illegible]~~ glass (from 240 to 5KV)
add 1 new glass for neutral } ~~[illegible]~~ 30 minutes

9. remove 3φ fiberglass tri-arm
add 8' crossarm
land wire on insulators
add neutral insulator } 1½ - 2 hours

Notes: Monday 8·28·95 8:30 AST

1. Black Rapids facility is not fed from Ft. Greely power system - It has its own generators and is a stand alone facility.

~~2. Ser No Eng 9-507-62-13~~

~~Changed to 71-03-03~~

~~July 1962~~

~~Additional Electrical Feeders~~

~~Plates J 25, K24 etc~~

~~13 sheets~~

~~3. Sheet~~ 51 ?

E M C ENGINEERS, INC.
2750 S. Wadsworth Blvd.
Suite C-200
Denver, CO 80227
(303) 988-2951

9755 Dogwood Rd.
Suite 220
Roswell, GA 30075
(404) 642-1864

JOB Ft. Greely EEAP Study
SHEET NO. 1 OF 4
CALCULATED BY F. Jones DATE 8-25-95
CHECKED BY DATE
SCALE N/A

1. GVEA transformer is 2500 KW upgraded to 3125 KW recently (added fans).
2. the load in the winter can get up to 3400-3500 KW so a generator is brought on line to cover the peak
3. there is enough generation to supply the whole base and they often do when GVEA goes down.

Feeder Breakers AM-5-50-4 G.E. Magneblast

Inst. Bulletin Sum # 396A571-3

GEI-23903

GEF-3391 parts

1200 A, 4160 V 60 cy
4760 V. max
8 cy interrupting time
50 MVA interrupting rating
7000 A inter... " @ rated V.
12500 A max interrupting
20000 A momentary

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JOB Ft Greely EEAP Study
SHEET NO. 2 OF 4
CALCULATED BY F. Jones DATE 8-25-95
CHECKED BY DATE
SCALE

Westinghouse DE-10W Air Circuit Bkr
4.16 KV
4.76 Max KV
1200 A 60 cy
5/1963 manufacture date
55B6621A30
50 DH 75

GVKA transformer
2800 KVA
%Z = 5.95
24.94/14.4 Y / 2400 Δ
added fans to go to 3125 KVA

When Base Load gets to about 2800 KW, a generator is started and loaded to 1000 KW to releive the transformer.

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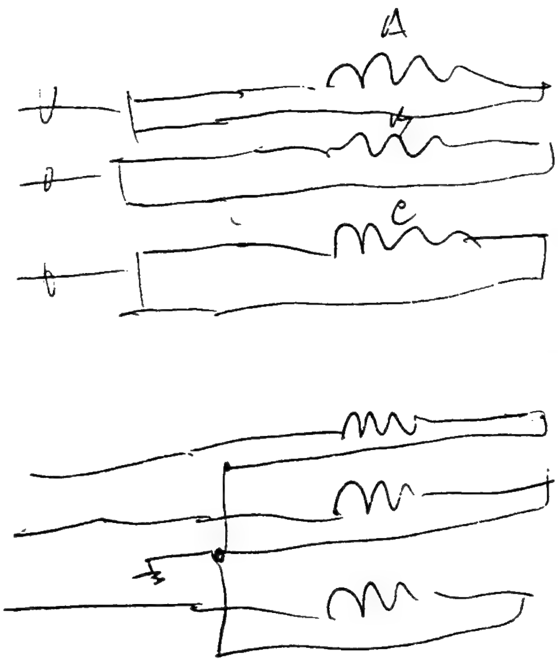
(404) 642-1864

JOB Ft. Greely EEAP Study
SHEET NO. 3 OF 4
CALCULATED BY F. Jones DATE 8/25/95
CHECKED BY ______ DATE ______
SCALE ______

generators can be rewired for 4160 Y
from 2400V Δ 1280 6 leads

Elliott Gen.
Ridgway, Pa

don't know about the 1000's though
looks like only 3 leads brought out



Check with Elliott for ratings of windings

Generators

1-3 - connected 2400V. Y ungrounded

4,5 - connected 2400 V. Δ
can be rewired for 4160 Y per the nameplate

takes 21 days to get film developed

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JOB Ft. Greely EEAP Study

CALCULATED BY E. Jones DATE 8/25/95
CHECKED BY DATE
SCALE

Sat.

1. go through log book
   get peaks demand
2. open j-box of 1000's
   see if they can be rewired for T3 4160V?
3. figure out overhead ties out front if possible
4. take pictures
5. get more data of trans. & machines
6. get copies of daily (24 HR sheet) of loads for last year
7. get copies of relay drawings & find out where readings are from.
8. tape record the nameplate data of the generators & the transformer in case photos don't turn out. Takes 21 days to get film developed.

APPENDIX C

Pole Testing Notes

installed ~ 1948
Near Bldg 162 - OLD Post - guess 40/2
(1) Sounded solid to the hammer
good ring
Drilling butt - seemed soft but it was
a Cedar pole which is soft anyway
shavings were very fine and seemed
a bit damp to the touch
a lot of severe checks
(2) Near Bldgs 400 area - Middle Post
guess 50/2 pole, installed ~ 1955
Had sort of a crack sound to the hammer
more of a thud with a crack.
Drilling butt - seemed soft again in the butt
but it is cedar - shavings fine and felt a bit
moist to the touch.
Drilled a hole about 5 ft up the pole and it
felt a bit more resistant than butt drill
a lot of severe checks
(3) Near Bldg 400 area - Middle Post
45/2 installed ~ 1985
Had a good crack when you hit it with the
hammer - sounded really solid
Drilling butt - seemed soft again but slightly
more resistant than (1) & (2) above
shavings were fine & seemed dry to the touch
The butts of even the old poles are probably in
pretty good shape compared to the #(3) pole
no checks

(4) Near AAF - OLD POST - Bldg 100
installed 1986 45/2 copper sulfate
treated - few checking
Sounded really solid to the hammer
good cracking sound - good sharp
crack
Drilling butt - seemed soft going in
got very stiff about 1/2 of drill bit in
at a 45° angle - may have hit a knot
initially felt about the same as #(3)

(5) Near main gate at Richardson Highway
installed 1957 45/2 penta treated (reddish)
Sounded really solid to the hammer good
crack - moderate checking
Drilling butt - very, very tough drilling
switched to a battery drill however
so that difference in torque may have
made a difference

(6) on Bolio Lake line 7200V, installed 1975
45/3 pole - moderate checking
Sounded really solid to the hammer - not
hollow
Drilling butt - very, very tough drilling
used battery drill however so the difference
in torque may have been significant

100' ruling span

Crossarm rot is prevalent
Damage by snow plows is prevalent
Carpenter ants on cedar poles is
moderately prevalent

most problems

(7) 1977 45/3 not sure of treatment.
ASP lateral off of feeder 7 near the
sewage lagoon. few checks
Sounded very solid to the hammer
Drilling butt: very, very difficult
using battery powered drill again
hard to compare with previous
drillings.

PoleTest™
"The Pole Strength Analyzer"

ASSESS THE STRENGTH OF YOUR WOOD POLES IN ONLY 3 TO 5 MINUTES!!

PoleTest™ is a simple-to-use instrument for predicting the bending strength of wood poles.

WHY STRENGTH?

Your system design is based on strength and your maintenance and upgrading decisions should be also.

All wood poles of the same species do not have the same fiber strength. In fact, based on the results of destructive tests, some poles of the same species and class may be more than three times stronger than others. Older poles may have an even wider range of strength. People working with wood recognize that poles exhibit significant strength variation but no one can distinguish a weak pole from a strong pole based on a visual inspection.

PoleTest™ is the ONLY wood pole test device which directly predicts pole strength. The reliability of the strength prediction using **PoleTest™** is unmatched by any other method, technique or instrument.

PoleTest™ is the culmination of research sponsored by EPRI* and EDM. **PoleTest™** is based on thousands of actual full-scale destructive tests and is not simply a theoretical approach. This extensive data base is available only in **PoleTest™**.

POLETEST™ USES:

- Determine the strength of wood poles
- Make upgrade or reconductor decisions
- Make pole repair/replacement decisions
- Determine line reliability
- Project future maintenance requirements
- Sort new poles to optimize use
- Determine code conformance
- Failure assessment and litigation support

EDM

ENGINEERING DATA MANAGEMENT, INC.

4700 McMurray Ave., Bldg. A
Fort Collins, Colorado 80525
Phone: 303/223-0457
Fax: 303/223-0484

* PoleTest™ incorporates technology developed for the Electric Power Industry under the sponsorship of the Electric Power Research Institute (EPRI).

JOIN THE LIST OF POLETEST™ USERS WHO ARE CURRENTLY SAVING MONEY BY MORE EFFECTIVELY MANAGING THEIR WOOD POLES

Pole Strength Assessment:

Destructive testing was conducted for *Tampa Electric Co.* on 24 southern pine poles that had been rejected using conventional inspection methods and 25 poles that were judged acceptable. Results showed that 50% of the rejected poles had adequate strength to remain in service, while 30% of the accepted poles did not have adequate strength.

Result - greater life from the good poles and greater reliability from the lines.

Upgrading and Rebuilding:

United Power Association used **PoleTest™** to evaluate a line to be upgraded. Several weak poles in the line were identified while the majority of poles were found to have sufficient strength to allow a cost-effective upgrade.

Result - A cost-effective upgrade was possible while retaining the reliability of the line.

Inspection Programs:

Idaho Power Company used **PoleTest™** to evaluate the strength of an older line that was getting expensive to maintain. The strength information indicated that replacing or repairing a small number of structures would result in the reliability of the line returning to an acceptable level.

Result - The life extension of the line proved to be a cost-effective option.

Montana Power is using **PoleTest™** to identify weak poles which require repair or replacement before winter. In addition, maintenance can be planned for the following year to repair structures that were found to be marginal, but not critical this year.

Result - Greater reliability of the lines and better utilization of existing manhours.

Maintenance and Replacement:

The *Electric Power Research Institute* (EPRI) says: Using present inspection methods, approximately 667 poles of a 10,000-pole line would be replaced annually. If by using the EPRI-developed NDE method to inspect poles, the useful life of only one-third of these 667 poles is extended 5 years, then the potential savings to the utility is on the order of $1,000,000 per year.

LET EDM SHOW YOU HOW TO COST EFFECTIVELY EXTEND THE LIFE AND INCREASE THE RELIABILITY OF YOUR WOOD POLE LINES.

ost-it™ brand

Fax Transmittal Memo 7672

No. of Pages 1 Today's Date 12/13/95 Time 11:45am MST

To Fred Jones

From Chuck Paulien

Co.

Company EDM

Location

Location Dept. Charge

Fax # Telephone #

Fax # Telephone #

303-985-2527

Comments Fred, Here is the Table Joe asked me to Fax to you. If you have any more questions give me or Joe a call.
Chuck Paulien

Original Disposition: ☐ Destroy ☐ Return ☐ Call for pickup

PoleTest™
Technical Supplement

Table 7
Typical Strength Limits for Use with PoleTest™

	Douglas-fir		Southern Pine		Western Redcedar	
	GL	Local	GL	Local	GL	Local
Grade B	3040	3400	4160	3390	2180	1900
Grade C (at Crossings)	2390	2550	2950	2600	1680	1560
Grade C (Elsewhere)	3770	3960	4550	4110	2560	2450

Butt treated C[illegible] Creosoted all the way

PoleTest™ INSPECTION REPORT

The Pole Strength Analyzer

copper sulfate treated

LINE OWNER: ______ INSPECTOR: ______ ACCELEROMETER SERIAL NO.

DIVISION: ______ DATE INSPECTED: ______ A: Creosoted all SHEET ______

LINE LOCATION: ______ POLETEST SERIAL NO: ______ B: ______ OF ______

Plinty treated

	1	2	3	4	5	6	7			
POLE ID	F5L71	F531L4	F5L41	F5L88	F9L43	1st pole in 1977 Bl[illegible]	F7L61			
SPECIES	WC	WC	DF	WC	DF	WC Run	DF			
GROUNDLINE DIAMETER (IN.)	13.8	14.3	15.2	13.0	13.6	13.7	12.3			
ACCELEROMETER ORIENTATION	45% IL	P	P	P	P	P	P			
GROUNDLINE READING (PSI)	4500	4260	6180	4750	6820	5140	6710			
LOCAL DIAMETER (IN.)										
LOCATION	GL	GL	GL	GL	GL	GL	GL			
ACCELEROMETER ORIENTATION										
LOCAL READING (PSI)										
COMMENTS										

SPECIES CODE:
DF - DOUGLAS-FIR
SP - SOUTHERN PINE
WC - WESTERN REDCEDAR
O - OTHER

ACCELEROMETER ORIENTATION CODE:
P - PERPENDICULAR TO LINE
IL - IN-LINE

LOCATION CODE:
GL - GROUNDLINE
XB - X-BRACE
XA - CROSSARM
O - OTHER, SPECIFY

EDM ENGINEERING DATA MANAGEMENT, INC.
(303) 223-0457
FORT COLLINS, CO

ENGINEERING DIVISION
WOOD POLE MANAGEMENT
AND CONSULTING SERVICES

2883

produce the final product. This classification includes upholstering operations.

2915 N/A—NY

PHRASEOLOGY VENEER PRODUCTS MFG. Includes veneer manufacturing.

CROSS-REF. State Special: Texas—Veneer Mfg.

SCOPE This classification applies to insureds who manufacture veneer and further process the veneer into a product. The sawing of logs into bolts, the softening of same in vats of hot water or steam rooms, then either turning, slicing or sawing and the final clipping of the single ply sheets to size and drying are the operations performed in the manufacture of rough veneer. Some rough veneer may be sold as a product.

The operations involved in the manufacture of veneer products will vary depending on the product to be manufactured. Wire stapling machines, wire hoop machines, clippers, table saws and, in some instances, punch presses for making metal parts are utilized in the manufacture of veneer barrels, baskets of woven veneer, wire staple baskets or wire staple fruit hampers of stripped veneer, tacked or wire staple berry boxes of sheet veneer and wire bound fruit crates of stripped veneer with or without turned wood slabs or ends.

In the manufacture of veneer seats, veneer panels, plywood panels and veneer covered furniture cores, wire working machines do not prevail but are supplanted by taping, gluing, clamping or pressing machines which are used to assemble the single ply veneer into two, three, four or more ply products. All veneer products operations, irrespective of character, are readily identified by the presence of a large amount of assembly work.

2916 N/A—CA

PHRASEOLOGY VENEER PRODUCTS MFG.—NO VENEER MFG.

SCOPE Code 2916 applies to insureds who manufacture products made from veneer but do not manufacture the veneer used in such products. "Veneer" has been defined as a thin layer of material, usually made of wood or plastic, which is used to cover the surface of another material. Veneer in most instances will have a superior quality surface when compared to the surface it covers. Refer to Code 2915 for risks which manufacture veneer and further process the veneer into a product. Refer to Code 4250 for risks which engage in the lamination of paper to manufacture paper or paper-like products.

As veneer-covered products are many and varied, there may be little operational similarity between risks contemplated by Code 2916.

Wire stapling machines, wire hoop machines, clippers, table saws and, in some instances, punch presses for making metal parts are utilized in the manufacture of woven, stripped or wire stapled veneer products such as barrels, baskets, fruit hampers, berry boxes and fruit crates with or without turned wood slabs or ends.

Taping, gluing, clamping and/or pressing machines are used to manufacture veneered products such as seats, panels, plywood, kitchen counter tops, desk tops, sink tops, chalkboards, bulletin boards and furniture cores. The manufacture of these products will generally involve the lamination of vinyl or plastic top coverings to particle boards. While the assembly of these products usually consists of the application of a single-ply veneer to another surface, processes that involve multi-ply applications are additionally contemplated by Code 2916.

Insureds who cover sheetrock with wallpaper have been assigned to Code 2916; however, wallpapering of walls is not considered a veneering operation and is contemplated by either Code 5474 or 5481.

All veneer product operations, irrespective of character, are readily identified by the presence of a large amount of assembly work involving the combining of two or more surfaces to each other.

2923

PHRASEOLOGY PIANO MFG. Includes assembling or finishing operations, and manufacturing of the piano action. Also applies to player pianos.

CROSS-REF. *Musical Instrument Mfg.—Wood—NOC; Organ Building & Installation.*

SCOPE This is a product classification which includes fabrication of metal frames, sounding boards, keyboards, wire and string graduation.

Musical Instrument Manufacturing—Wood—NOC—contemplates the manufacture of instruments made of wood. Case manufacturing and the tanning of skins used in manufacturing wooden drums, tambourines and banjos have been considered incidental to the operations assigned to Code 2923.

Organ Building And Installation—contemplates the manufacture of the complete organ including installation as well as the manufacture of the keyboards, sounding boards, action boards, metal frames, metal organ pipes, switches, relays, magnets, wind chests, wind reservoirs and blower systems.

2942 N/A—CA, MN

PHRASEOLOGY PENCIL MFG.

CROSS-REF. *Crayon Mfg.; Penholder Mfg.*

SCOPE Applicable to the manufacture of crayons, penholders, lead, wax copying and colored pencils encased in wood. Operations usually begin with raw logs, or pencil slats which are purchased from pencil stock manufacturers. Equipment involves grinding mills, wood shapers, kilns, extrusion press, punch press and dipping or spraying apparatus. Metal eraser tips are stamped out on presses and fitted with rubber erasers either by the insured or by subcontractors.

2960

PHRASEOLOGY WOOD PRESERVING & DRIVERS. Includes yard or incidental woodworking operations.

CROSS-REF. *Tie Yard & Drivers*—includes preserving operations. Codes 2960 and 8232—Lumberyard or 2702—Logging or Lumbering shall not be assigned to the same risk unless the operations described by these classifications are conducted as separate and distinct businesses. *Pole Yard & Drivers*. This cross-reference has the same footnote as Tie Yard & Drivers.

SCOPE Wood piles, poles, crossties, lumber and items to be preserved are delivered at treating plant where the items are peeled, seasoned (air- or kiln-dried) and machined, if necessary, before treating. Preservatives fall into two general classes: oils, such as creosote and petroleum solutions of pentachlorophenol, and waterborne salts applied as water solutions. The preservative may be applied by pressure or superficially by spraying, brushing, dipping and soaking. Treated wood is then inspected, stored and shipped.

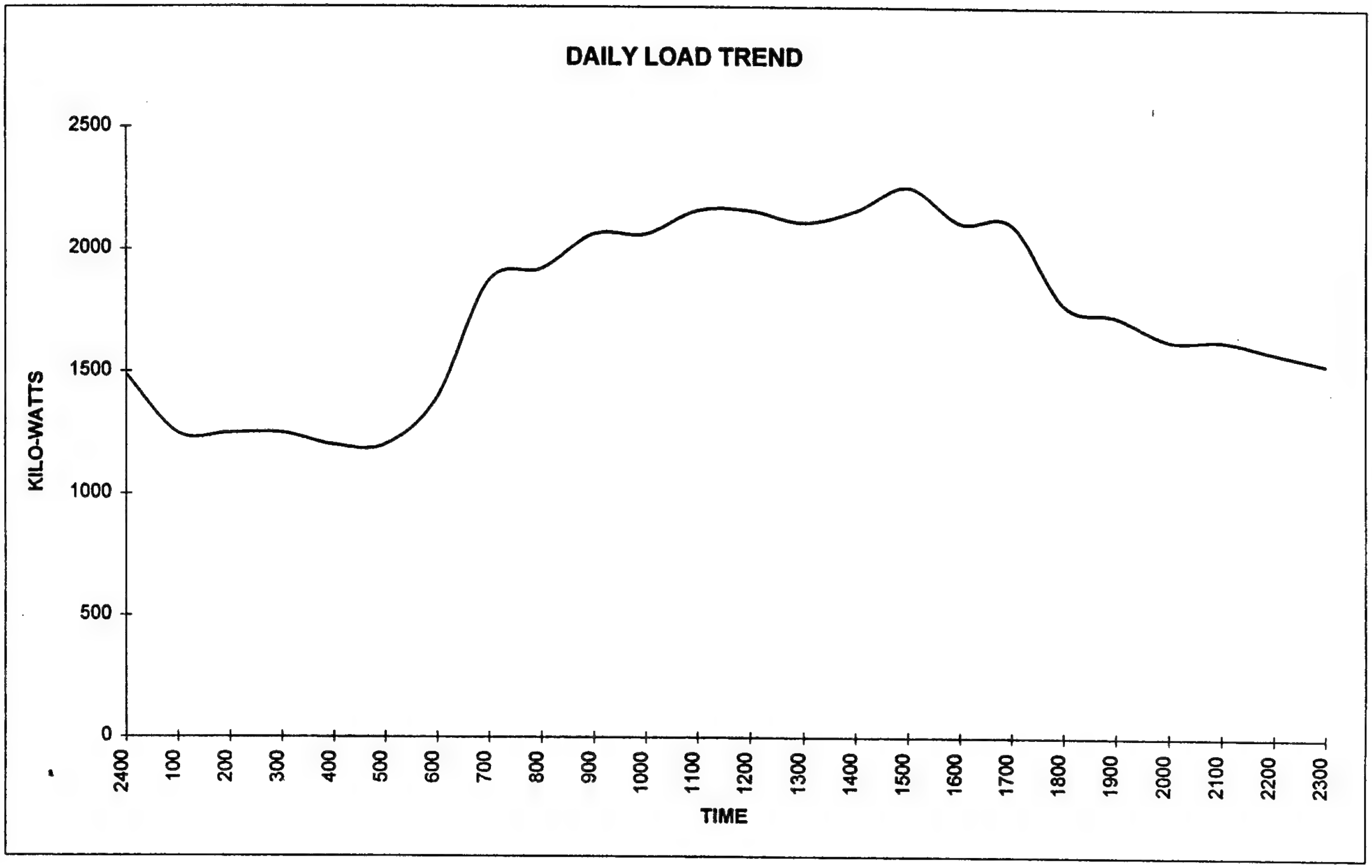
A ★ next to a code number indicates an updated scope.

APPENDIX D

Load Analysis

Electric Power Plant Operating Log For
5-Jul-95

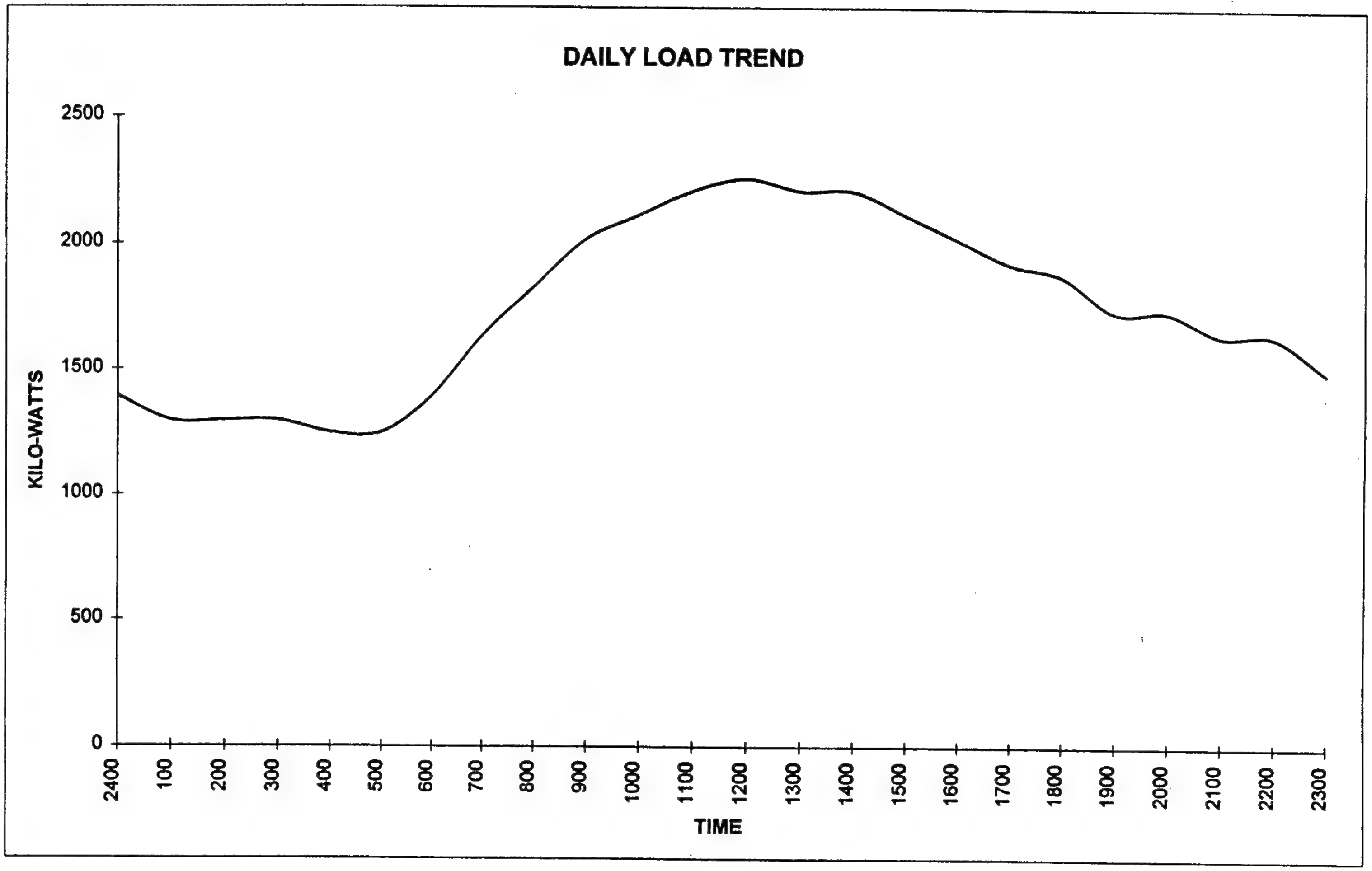
TIME	PLANT TOTALIZER METER
2400	1488
100	1248
200	1248
300	1248
400	1200
500	1200
600	1392
700	1872
800	1920
900	2064
1000	2064
1100	2160
1200	2160
1300	2112
1400	2160
1500	2256
1600	2112
1700	2106
1800	1776
1900	1728
2000	1632
2100	1632
2200	1584
2300	1536



TOTAL KWH 41898
PEAK KW 2256
LOAD FACTOR 77.4%

Electric Power Plant Operating Log For
23-Jun-95

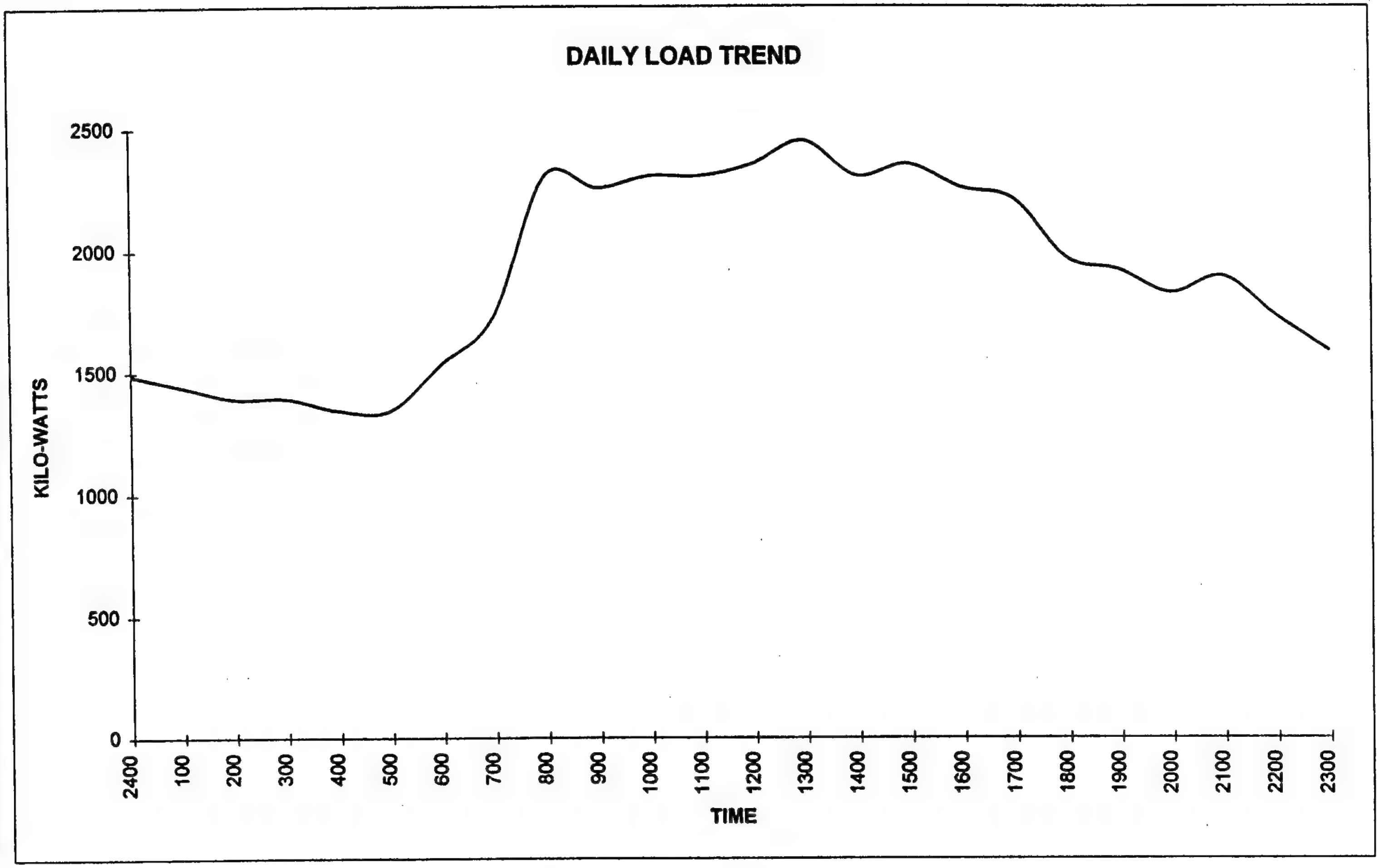
TIME	PLANT TOTALIZER METER
2400	1392
100	1296
200	1296
300	1296
400	1248
500	1248
600	1392
700	1632
800	1824
900	2016
1000	2112
1100	2208
1200	2256
1300	2208
1400	2206
1500	2112
1600	2016
1700	1920
1800	1872
1900	1728
2000	1728
2100	1634
2200	1632
2300	1488



TOTAL KWH	41760
PEAK KW	2256
LOAD FACTOR	77.1%

Electric Power Plant Operating Log For
16-May-95

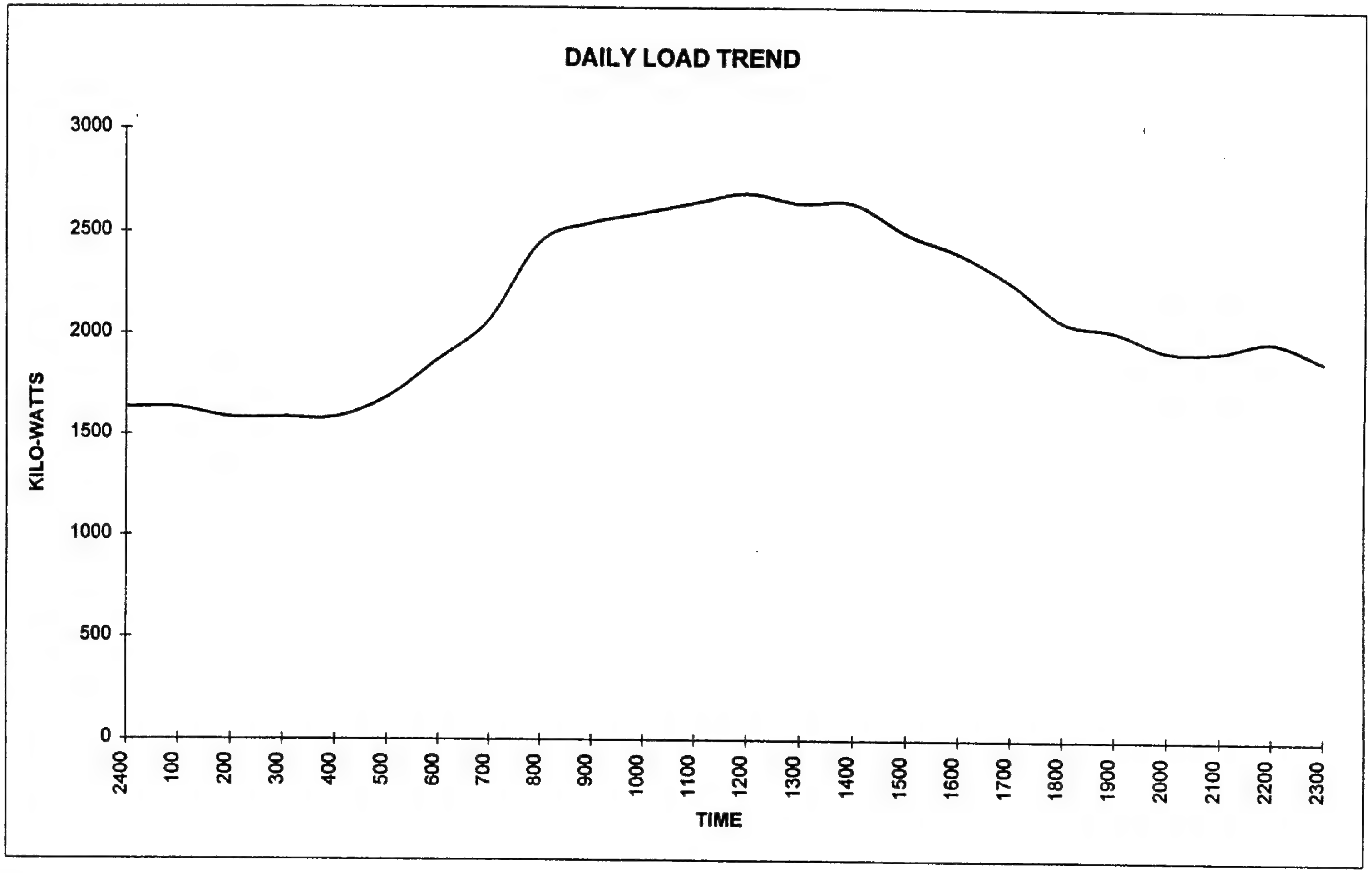
TIME	PLANT TOTALIZER METER
2400	1488
100	1440
200	1392
300	1392
400	1344
500	1344
600	1536
700	1728
800	2304
900	2256
1000	2304
1100	2304
1200	2352
1300	2448
1400	2304
1500	2352
1600	2256
1700	2208
1800	1968
1900	1920
2000	1824
2100	1892
2200	1728
2300	1584



TOTAL KWH	45668
PEAK KW	2448
LOAD FACTOR	77.7%

Electric Power Plant Operating Log For
5-Apr-95

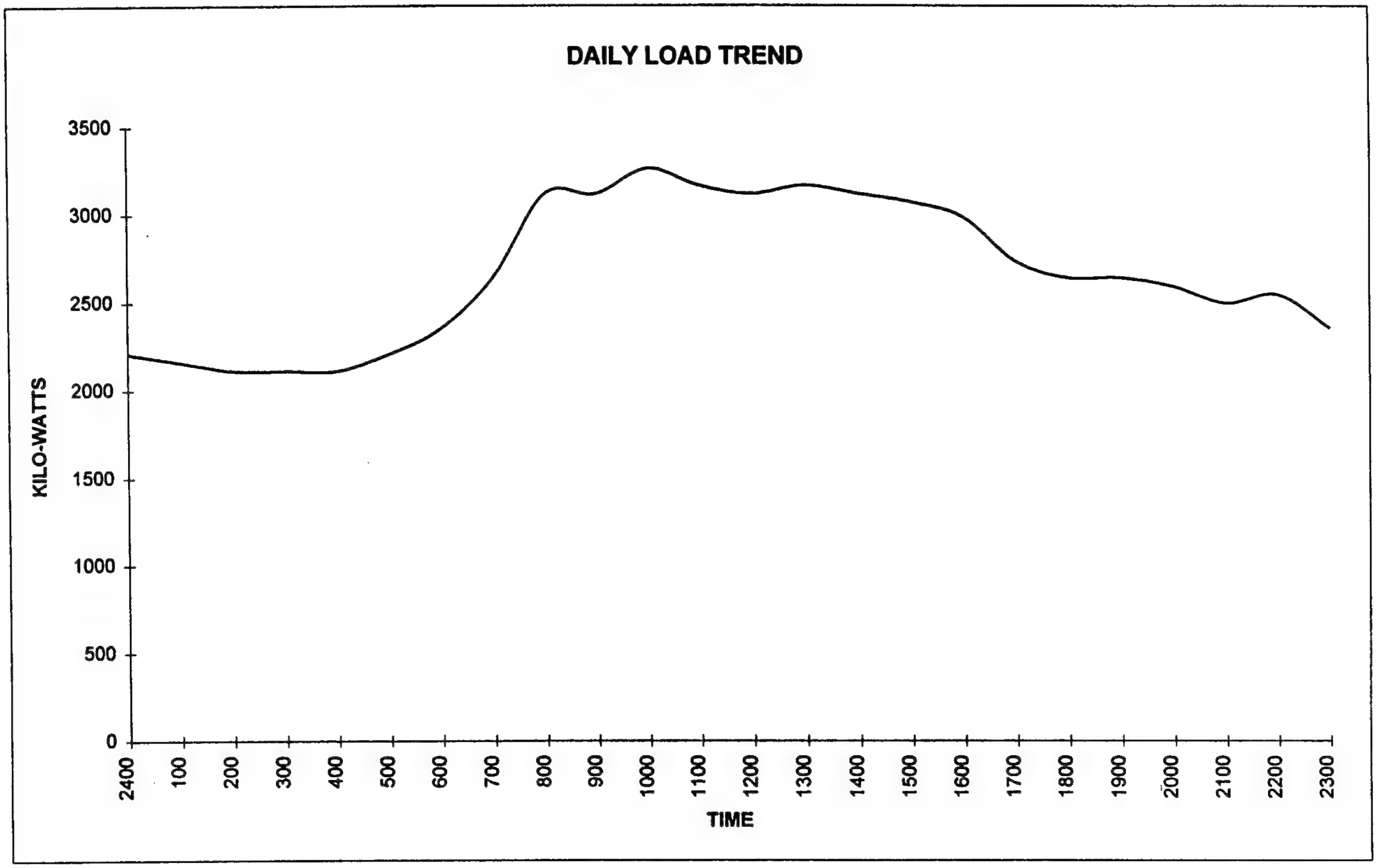
TIME	PLANT TOTALIZER METER
2400	1632
100	1632
200	1584
300	1584
400	1584
500	1682
600	1872
700	2064
800	2448
900	2544
1000	2592
1100	2640
1200	2688
1300	2640
1400	2640
1500	2496
1600	2400
1700	2256
1800	2064
1900	2016
2000	1920
2100	1920
2200	1968
2300	1872



TOTAL KWH	50738
PEAK KW	2688
LOAD FACTOR	78.6%

Electric Power Plant Operating Log For
14-Mar-95

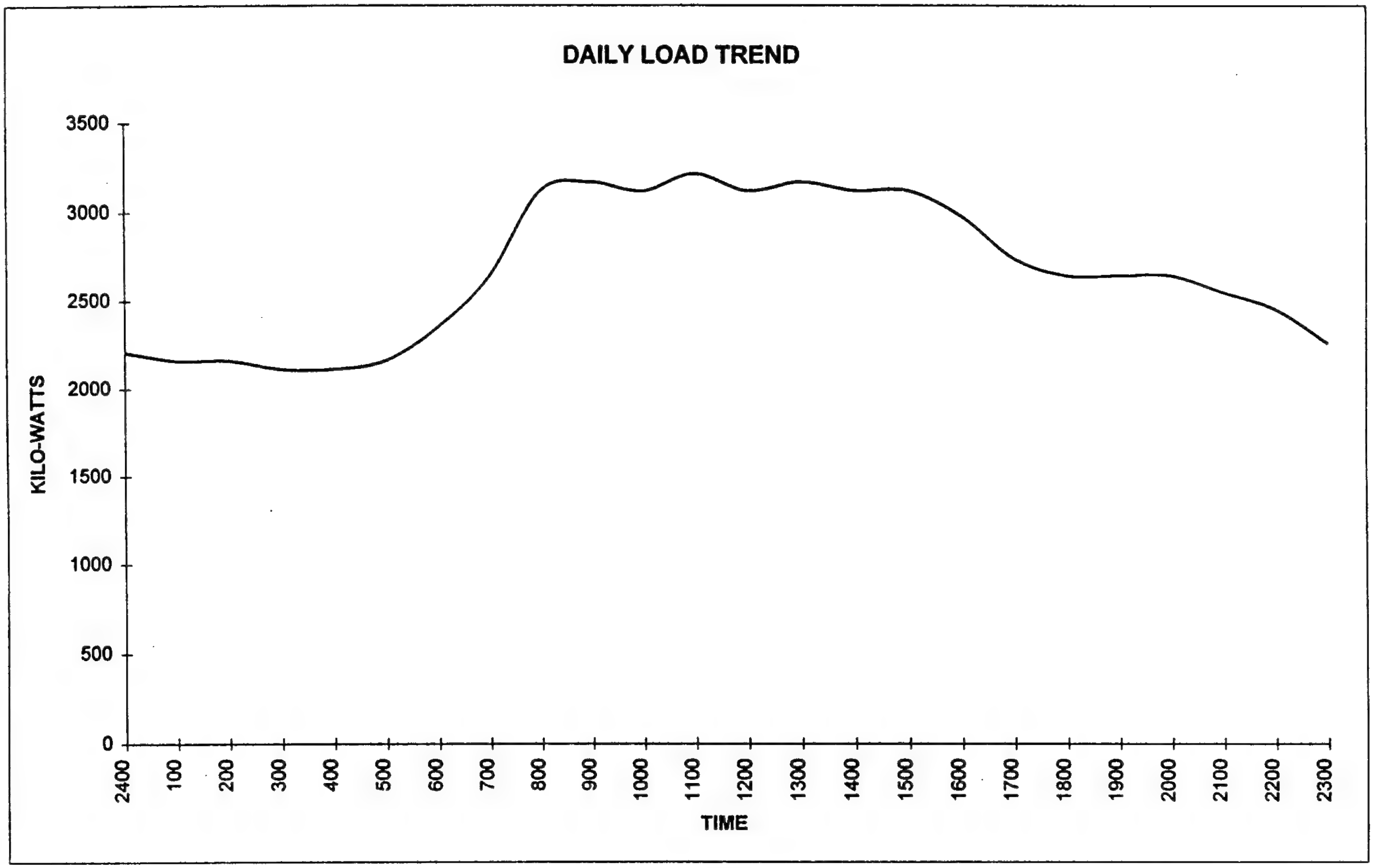
TIME	PLANT TOTALIZER METER
2400	2208
100	2160
200	2112
300	2112
400	2112
500	2208
600	2352
700	2640
800	3120
900	3120
1000	3264
1100	3168
1200	3120
1300	3168
1400	3120
1500	3072
1600	2986
1700	2736
1800	2640
1900	2640
2000	2592
2100	2496
2200	2544
2300	2354



TOTAL KWH	64044
PEAK KW	3264
LOAD FACTOR	81.8%

Electric Power Plant Operating Log For
23-Feb-95

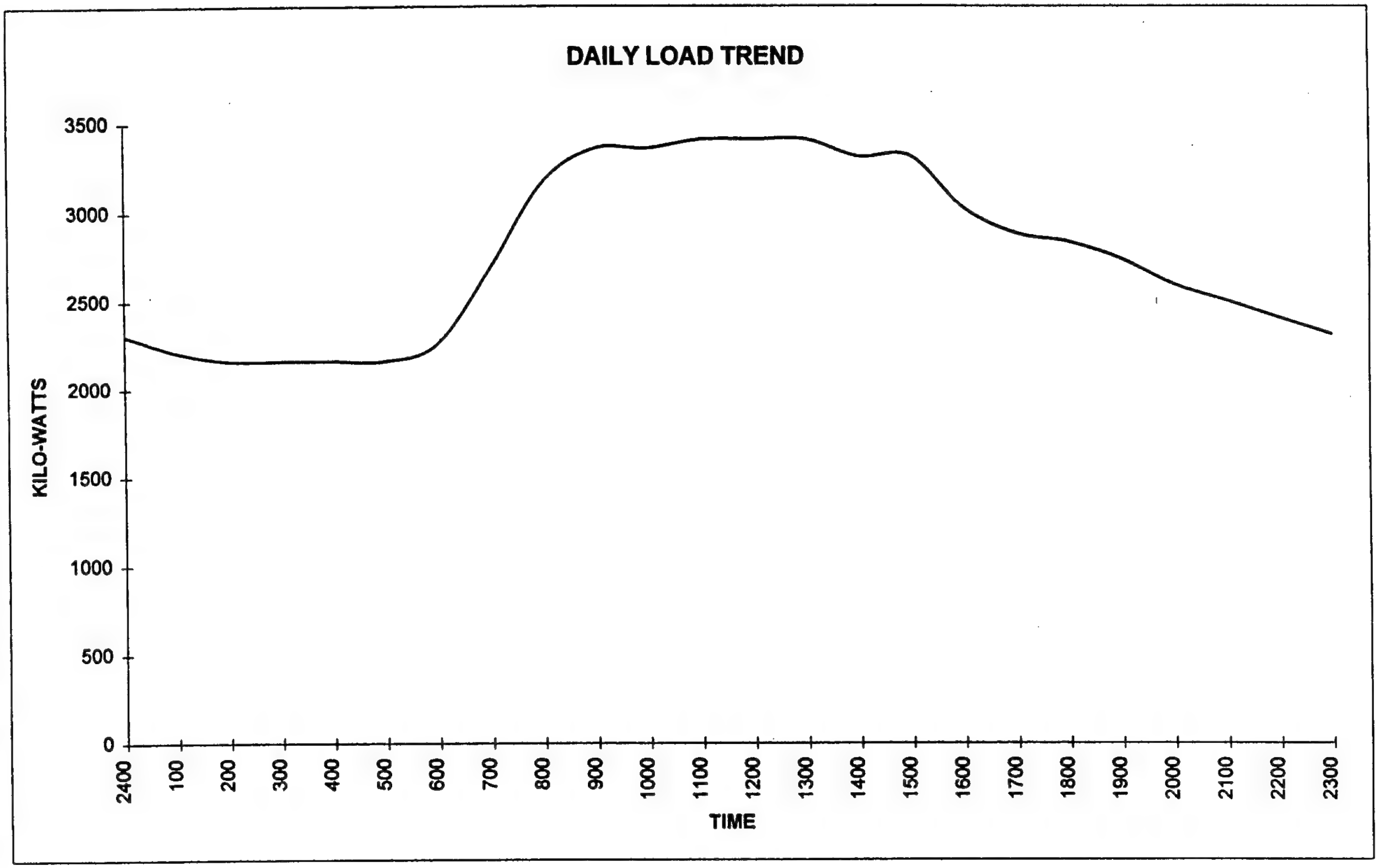
TIME	PLANT TOTALIZER METER
2400	2208
100	2160
200	2160
300	2112
400	2112
500	2160
600	2350
700	2640
800	3120
900	3168
1000	3120
1100	3216
1200	3120
1300	3168
1400	3120
1500	3120
1600	2976
1700	2736
1800	2640
1900	2640
2000	2640
2100	2544
2200	2448
2300	2256



TOTAL KWH	63934
PEAK KW	3216
LOAD FACTOR	82.8%

Electric Power Plant Operating Log For
27-Jan-95

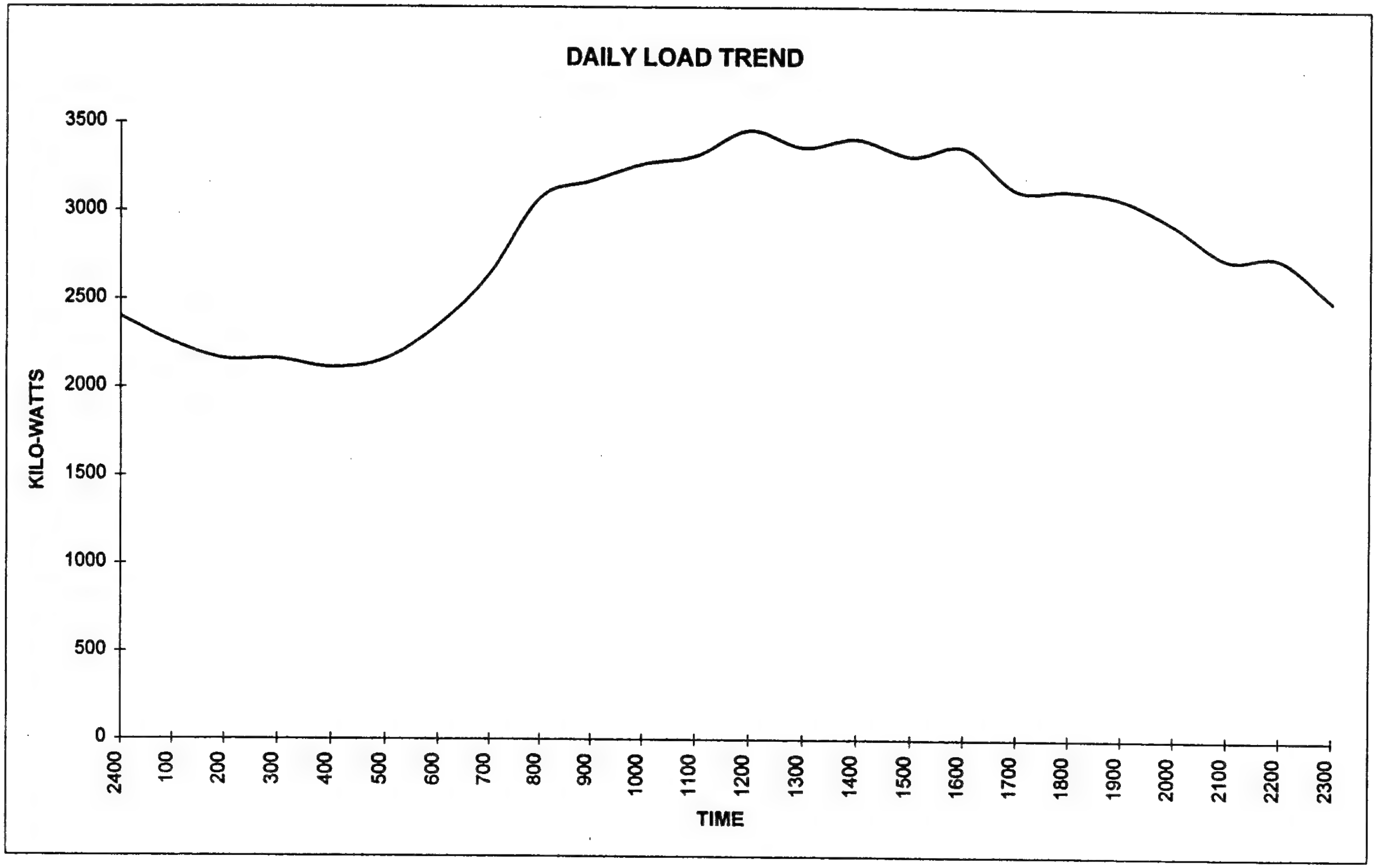
TIME	PLANT TOTALIZER METER
2400	2304
100	2208
200	2160
300	2160
400	2160
500	2160
600	2257
700	2688
800	3168
900	3360
1000	3360
1100	3408
1200	3408
1300	3408
1400	3312
1500	3312
1600	3024
1700	2880
1800	2832
1900	2736
2000	2592
2100	2496
2200	2400
2300	2304



TOTAL KWH	66097
PEAK KW	3408
LOAD FACTOR	80.8%

Electric Power Plant Operating Log For
7-Dec-94

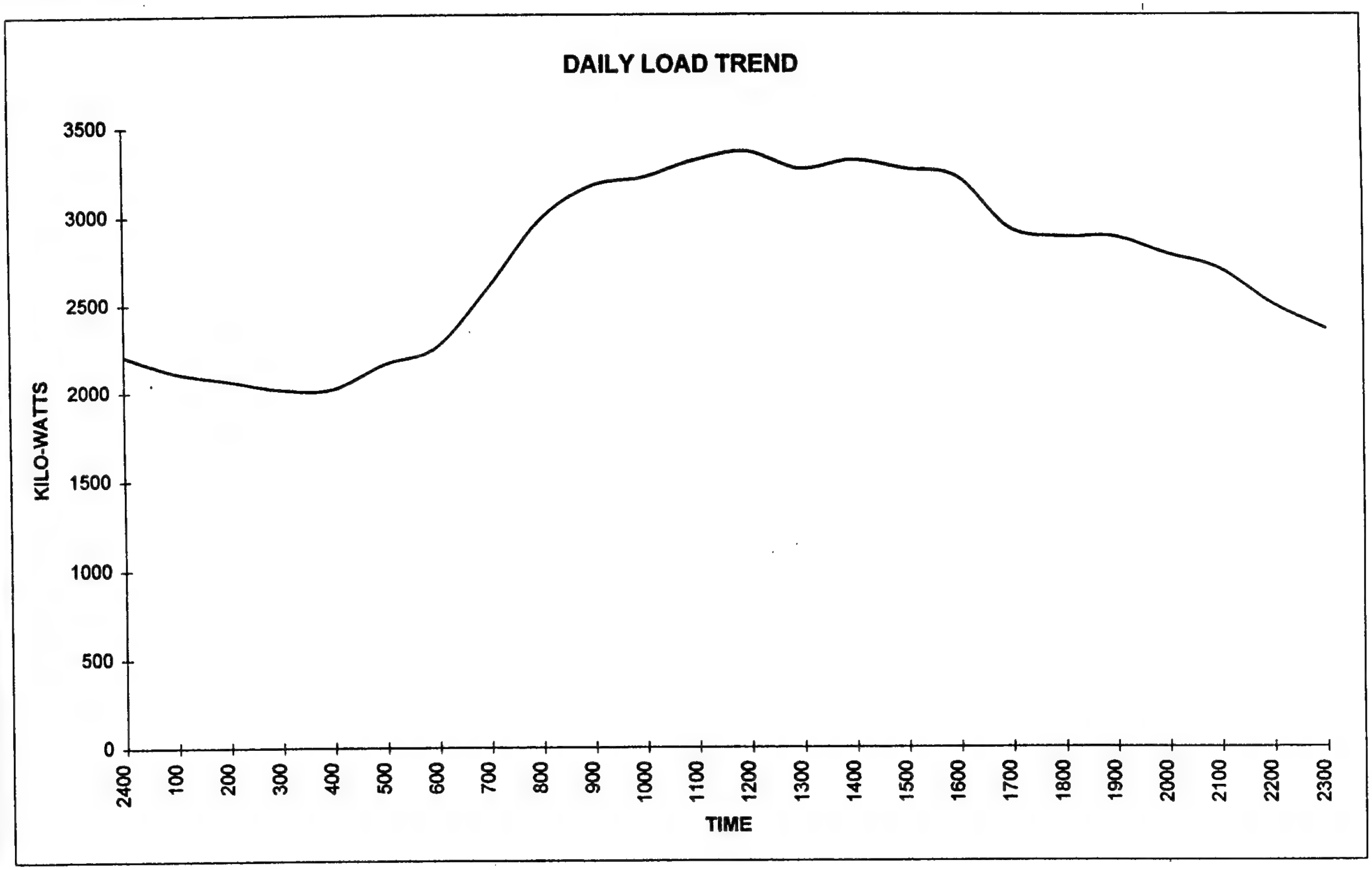
TIME	PLANT TOTALIZER METER
2400	2400
100	2256
200	2160
300	2160
400	2112
500	2160
600	2352
700	2640
800	3072
900	3168
1000	3264
1100	3312
1200	3456
1300	3360
1400	3408
1500	3312
1600	3360
1700	3122
1800	3120
1900	3072
2000	2928
2100	2732
2200	2736
2300	2496



TOTAL KWH	68158
PEAK KW	3456
LOAD FACTOR	82.2%

Electric Power Plant Operating Log For
30-Nov-94

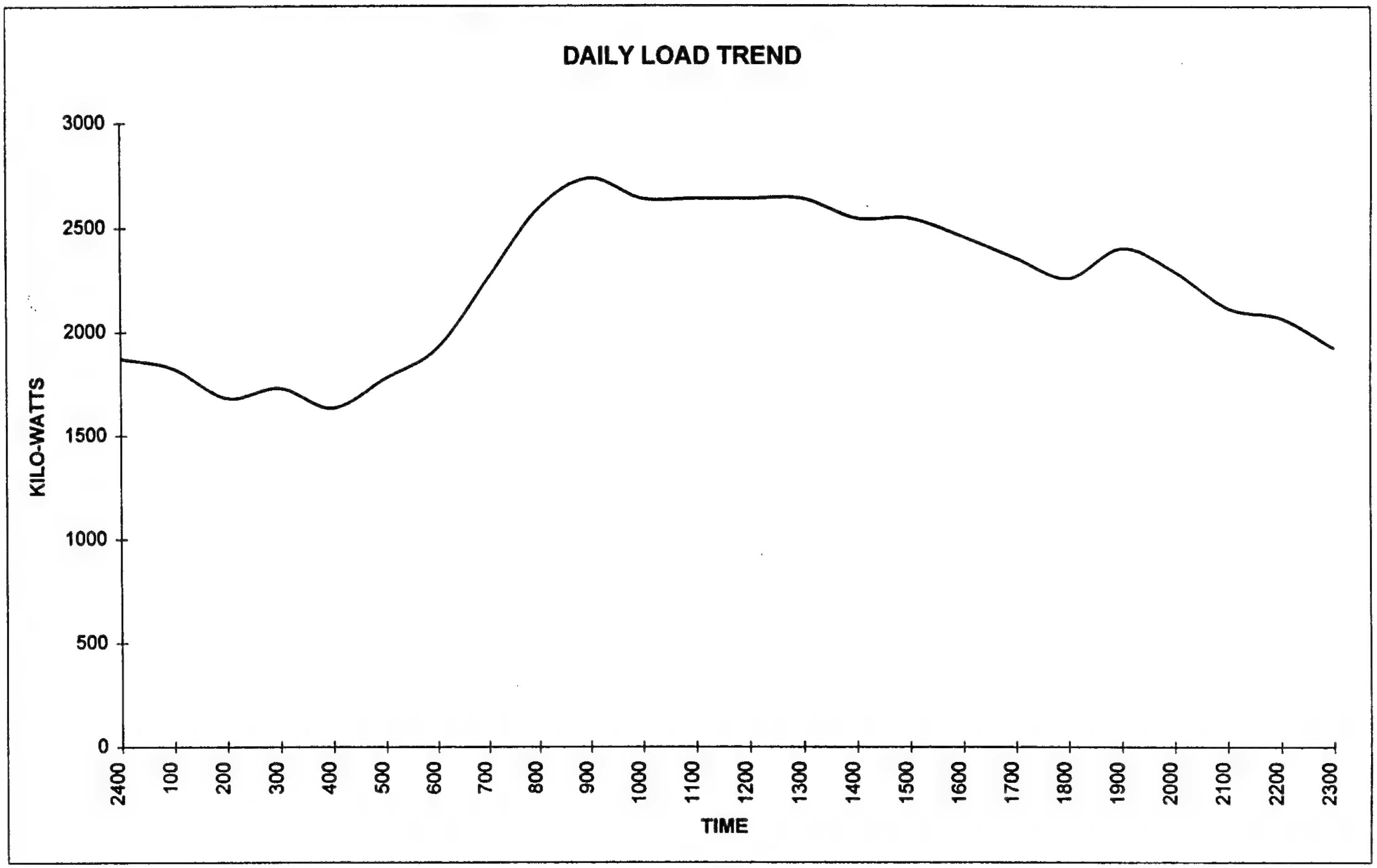
TIME	PLANT TOTALIZER METER
2400	2208
100	2112
200	2064
300	2016
400	2016
500	2160
600	2256
700	2592
800	2976
900	3168
1000	3216
1100	3312
1200	3360
1300	3264
1400	3312
1500	3264
1600	3216
1700	2928
1800	2880
1900	2880
2000	2784
2100	2698
2200	2496
2300	2352



TOTAL KWH	65530
PEAK KW	3360
LOAD FACTOR	81.3%

Electric Power Plant Operating Log For
27-Oct-94

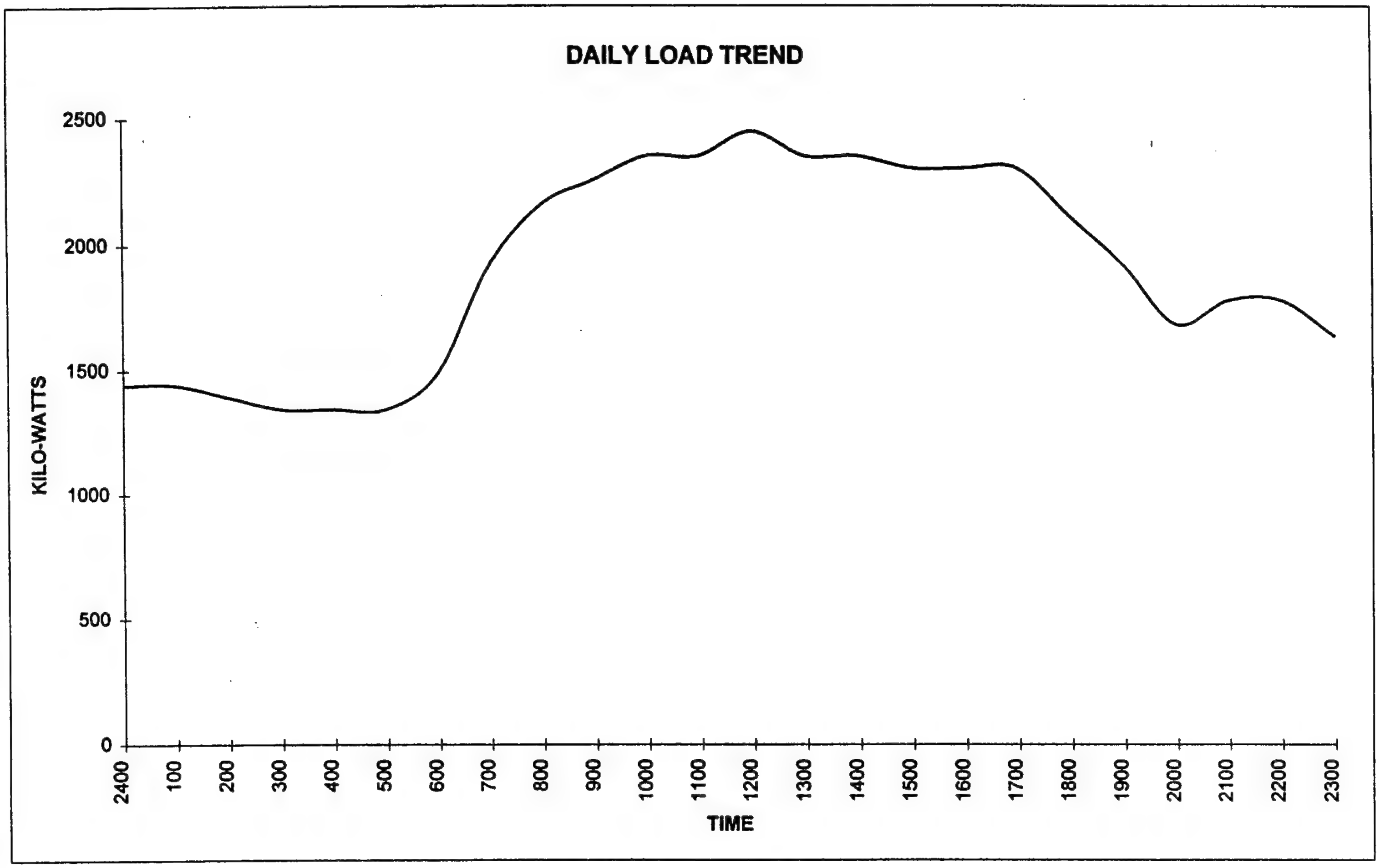
TIME	PLANT TOTALIZER METER
2400	1872
100	1824
200	1680
300	1728
400	1632
500	1776
600	1920
700	2256
800	2592
900	2736
1000	2640
1100	2640
1200	2640
1300	2640
1400	2544
1500	2544
1600	2456
1700	2352
1800	2256
1900	2400
2000	2286
2100	2112
2200	2064
2300	1920



TOTAL KWH	53510
PEAK KW	2736
LOAD FACTOR	81.5%

Electric Power Plant Operating Log For
14-Sep-94

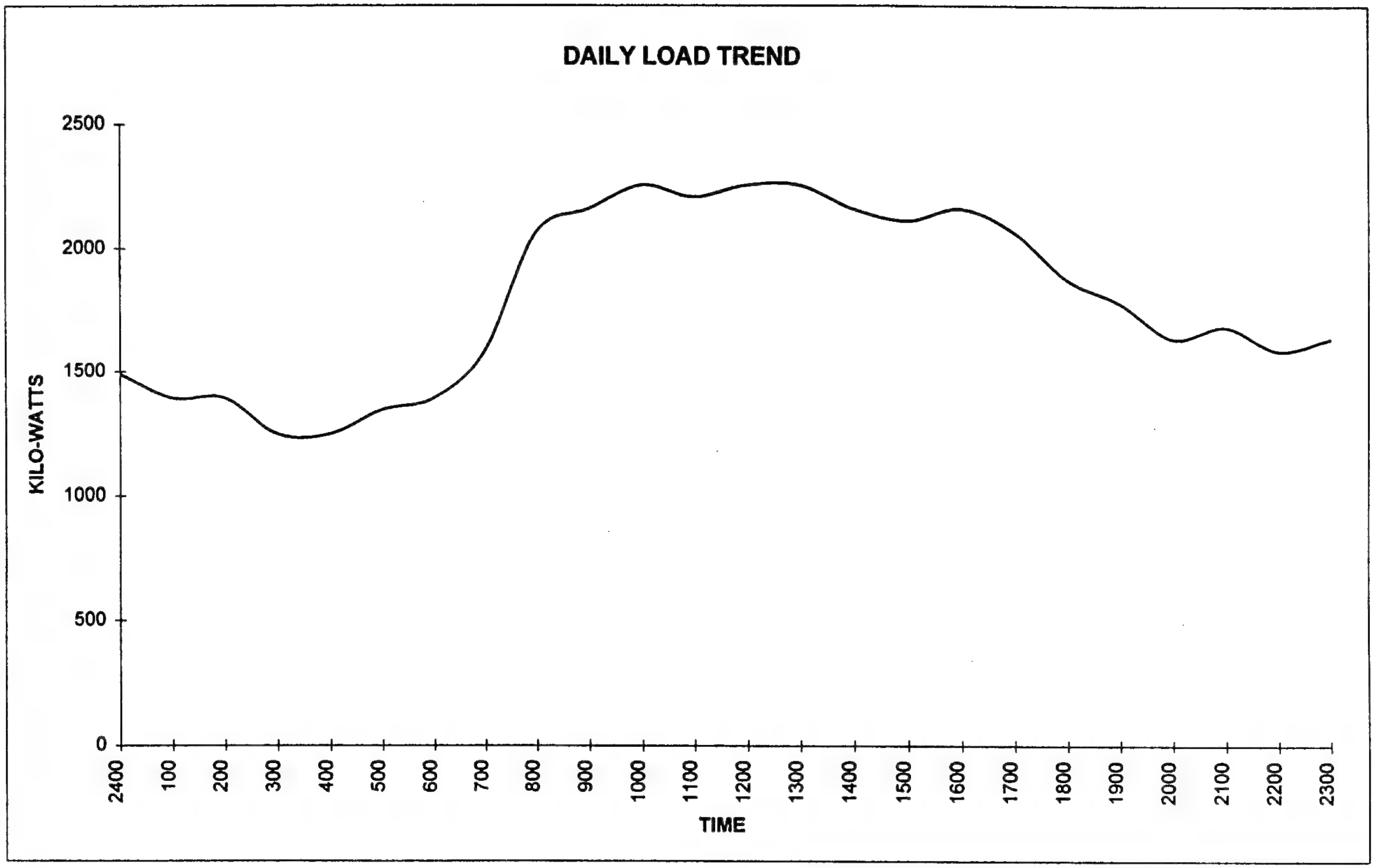
TIME	PLANT TOTALIZER METER
2400	1440
100	1440
200	1392
300	1344
400	1344
500	1344
600	1488
700	1920
800	2160
900	2256
1000	2352
1100	2352
1200	2448
1300	2352
1400	2352
1500	2304
1600	2304
1700	2304
1800	2112
1900	1920
2000	1680
2100	1776
2200	1776
2300	1632



TOTAL KWH	45792
PEAK KW	2448
LOAD FACTOR	77.9%

Electric Power Plant Operating Log For
29-Aug-94

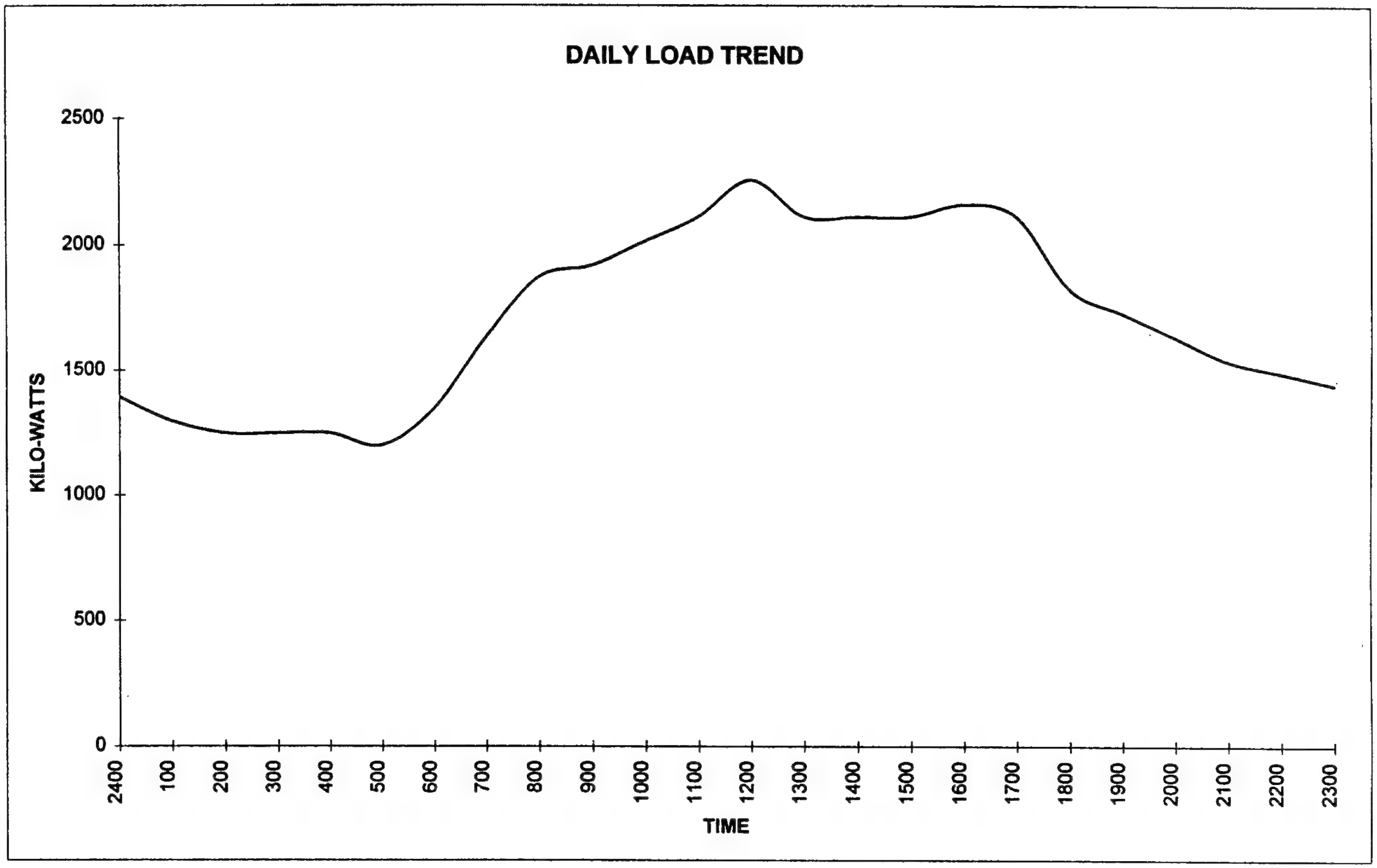
TIME	PLANT TOTALIZER METER
2400	1488
100	1392
200	1392
300	1248
400	1248
500	1344
600	1392
700	1584
800	2064
900	2160
1000	2256
1100	2208
1200	2256
1300	2256
1400	2160
1500	2112
1600	2160
1700	2064
1800	1872
1900	1776
2000	1632
2100	1680
2200	1584
2300	1632



TOTAL KWH	42960
PEAK KW	2256
LOAD FACTOR	79.3%

Electric Power Plant Operating Log For
21-Jul-94

TIME	PLANT TOTALIZER METER
2400	1392
100	1296
200	1248
300	1248
400	1248
500	1200
600	1344
700	1632
800	1872
900	1920
1000	2016
1100	2112
1200	2256
1300	2112
1400	2112
1500	2112
1600	2160
1700	2112
1800	1824
1900	1728
2000	1632
2100	1536
2200	1488
2300	1440



TOTAL KWH	41040
PEAK KW	2256
LOAD FACTOR	75.8%

ELECTRIC POWER PLANT OPERATING LOG

INSTALLATION: FORT GREELY, ALASKA

ELECTRICAL GENERATION AND DISTRIBUTION LOG

DATE: 5 July 95

	GENERATORS															GVEA					KILOWATT DEMAND				FEEDERS										
	UNIT NO. #4					UNIT NO.					UNIT NO.										TOTAL GEN	STATION SERVICE													BATTERY VOLTAGE
	LOAD KW	LOAD KVAR	AC AMP	P.F. %	TEMP	LOAD KW	LOAD KVAR	AC AMP	P.F. %	TEMP	LOAD KW	LOAD KVAR	AC AMP	P.F. %	TEMP KV	LOAD KW	LOAD KVAR	AC AMP	P.F. %	TEMP		1	2	500	2	5	4	1	3	9	7	8	KW IN	KVAR IN	
2400	950	~~x~~	~~250~~	~~.90~~	~~55~~										2.4	1300	700	340	.87	4	1488	22	2		72	72	5	50	55	5	25	55	8555	3987	134
0100															2.4	1200	700	330	.85	4	1248	22	3		72	5	50	45	5	5	25	50	8556	3987	134
0200															2.4	1100	700	320	.85	4	1248	23	3		72	5	50	45	5	5	25	40	8556	3987	134
0300															2.4	1200	700	320	.84	4	1248	23	12		72	5	50	45	5	5	35	30	8557	3988	134
0400															2.4	1100	700	310	.84	4	1200	23	3		72	5	50	45	5	5	25	35	8557	3988	134
0500															2.4	1100	700	310	.84	4	1200	23	13		72	5	50	45	5	5	25	35	8558	3988	134
0600															2.4	1400	700	370	.90	6	1392	22	3		90	5	55	50	5	10	30	50	8558	3989	134
0700															2.4	1600	800	420	.90	6	1872	23	8		92	5	60	60	10	15	35	40	8559	3989	134
0800															2.4	1900	800	500	.92	6	1920	29	8		110	5	73	62	25	30	40	62	8559	3989	134
0900															2.4	2000	800	520	.93	6	2064	22	5		110	5	77	70	50	30	65	40	8560	3990	134
1000															2.4	2100	900	520	.93	6	2064	22	6		111	5	82	67	50	30	55	50	8561	3990	134
1100															2.4	2200	900	580	.93	6	2160	22	20		120	5	87	65	50	30	65	60	8562	3990	134
1200															2.4	2100	900	540	.93	6	2160	30	8		115	5	82	68	48	30	55	62	8563	3991	134
1300	950	x	250	.90	55										2.4	1100	300	280	.93	1	2112	29	15		115	5	80	68	50	35	50	62	8563	3991	134
1400	900	x	240	.90	x										2.4	1200	300	300	.93	1	2160	22	15		118	5	82	62	50	35	55	60	8564	3991	134
1500															2.4	2100	900	550	.93	6	[redacted]	22	10		120	5	80	60	52	35	55	72	8565	3991	134
1600															2.4	2000	900	530	.93	5	2112	22	10		118	5	80	60	55	35	55	70	8565	3992	134
1700															2.4	1800	800	480	.92	5	2016	22	10		105	5	75	60	45	30	45	75	8566	3992	134
1800															2.4	1600	800	430	.90	5	1776	22	5		90	5	75	55	10	25	35	65	8567	3992	134
1900															2.4	1600	800	430	.90	5	1728	22	10		90	5	65	70	5	5	30	65	8568	3993	134
2000															2.4	1500	800	400	.88	5	1632	22	10		85	5	62	60	5	5	30	70	8568	3993	134
2100															2.4	1500	800	410	.88	5	1632	24	20		85	5	60	60	5	5	30	75	8569	3993	134
2200															2.4	1500	800	400	.88	5	1584	38	10		90	5	50	60	5	5	30	75	8569	3994	134
2300															2.4	1500	800	410	.88	5	1536	30	5		85	5	50	60	5	5	50	70	8570	3994	134

TIME	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	SMA	STA SV 1	STA SV 2	G	V	E	A	KVAR	FEEDER 2	FEEDER 5	FEEDER 4	FEEDER 1	FEEDER 3	FEEDER 7	FEEDER 8	FEEDER 9	TOTALIZER
2400	05665		18019	43111		0831	0165	9561	0065	2158	8571		3994	68456	61623	2612	67497	78899	5449	4495	0252	4776
0000	05634	92046	18016	43076	13527	0831	0160	9562	0027	2158	8555		3987	68423	61615	2589	67481	78886	5403	4420	0243	4737
TOTAL	31		3	35			5	1	38		16		7	33	8	23	16	13	46	55	9	39

MIDNIGHT OPERATOR

Gelhart / Parsons
DAY OPERATOR

AFTERNOON OPERATOR

ELECTRIC POWER PLANT OPERATING LOG

INSTALLATION: Fort Greely, AK. ELECTRICAL GENERATION AND DISTRIBUTION LOG DATE: 23 June 1995

GENERATORS

TIME	Unit No. 1 Load KW	Unit No. 1 Load KVAR	Unit No. 1 AC AMP	Unit No. 1 P.F. %	Unit No. 1 TEMP	Unit No. 2 Load KW	Unit No. 2 Load KVAR	Unit No. 2 AC AMP	Unit No. 2 P.F. %	Unit No. 2 TEMP	Unit No. 4 Load KW	Unit No. 4 Load KVAR	Unit No. 4 AC AMP	Unit No. 4 P.F. %
2400														
0100														
0200														
0300														
0400														
0500														
0600														
0700														
0800														
0900														
1000	800	—	200	.94		800	—	215	.92					
1100	780	—	200	.92		off		line			750	—	210	.88
1200	750	—	190	.91							900	—	230	.9
1300	700	—	185	.9							250		215	.89
1400														
1500														
1600														
1700														
1800														
1900														
2000														
2100														
2200														
2300														

Unit No. GVEA / Kilowatt Demand / FEEDERS

TIME	KV	GVEA Load KW	GVEA Load KVAR	GVEA AC AMP	GVEA P.F. %	TAP	Total Gen	Station Service 1	Station Service 2		2	5	4	1	3	9	7	8	KW IN	KVAR IN	BATTERY VOLTAGE
2400	2.4	1200	700	350	.81	5	1392	25	7	X	72	5	46	46	5	60	28	68	18382	3893	134
0100	2.4	1200	700	335	.86	5	1296	25	7	X	73	5	45	45	5	15	24	50	18383	3893	134
0200	2.4	1200	800	335	.86	5	1294	25	8	X	71	5	45	46	5	15	33	42	18383	3894	134
0300	2.4	1200	800	325	.86	6	1296	25	7	X	72	5	45	46	5	20	35	32	18384	3894	134
0400	2.4	1200	800	325	.85	6	1248	25	8	X	75	5	48	40	5	20	25	33	18384	3894	134
0500	2.4	1200	800	325	.85	6	1248	25	8	X	78	5	45	46	5	30	27	31	18385	3895	134
0600	2.4	1200	800	310	.86	6	1392	29	15	X	80	5	63	47	5	20	25	40	18385	3895	134
0700	2.4	1500	800	415	.90	6	1632	26	9	[redacted]	92	5	70	56	10	40	30	41	18386	3896	134
0800	2.4	1700	800	465	.92	6	1824	28	15	[redacted]	115	10	80	66	10	30	35	40	18387	3896	134
0900	2.4	1900	800	500	.92	6	2016	26	15	[redacted]	110	10	75	68	20	40	65	48	18387	3896	134
1000	2.4	400	200	0	.85	N	2112	45	15	[redacted]	115	10	85	75	20	25	45	52	8388	3896	134
1100	2.4	600	200	150	.86	1	2208	35	14	[redacted]	115	10	95	95	20	40	60	72	18388	3897	134
1200	2.4	500	200	100	.89	1	[redacted]	39	18	[redacted]	112	10	80	80	20	25	60	68	18388	3897	134
1300	2.4	900	200	160	.91	M	2208	35	20	[redacted]	112	10	82	74	25	30	64	89	18389	3897	134
1400	2.4	2100	900	540	.92	6	2206	30	14	[redacted]	108	10	78	72	20	25	55	75	18389	3897	134
1500	2.4	2000	900	520	.91	7	2112	38	14	[redacted]	110	10	80	62	20	25	55	55	18390	3897	134
1600	2.4	1900	900	500	.92	5	2016	32	5	[redacted]	108	10	72	72	20	20	46	75	18391	3898	134
1700	2.4	1900	800	480	.90	4	1920	26	5	/	98	10	78	70	5	20	40	65	18392	3898	134
1800	2.4	1800	800	480	.90	4	1872	25	20	/	95	10	70	70	5	20	35	25	18392	3898	134
1900	2.4	1700	800	450	.90	4	1728	26	5	/	82	18	70	85	5	20	30	75	18393	3899	134
2000	2.4	1600	800	440	.90	3	1728	25	5	/	78	10	60	70	5	20	40	65	18394	3899	134
2100	2.4	1600	800	420	.90	3	1634	27	5	/	82	10	60	60	5	20	40	65	18394	3899	84
2200	2.4	1500	800	420	.89	3	1632	38	10	/	85	10	60	68	5	19	30	65	18395	3900	134
2300	2.4	1400	800	380	.88	3	1488	25	5	/	70	10	50	55	5	20	30	55	8396	3900	134

Meter readings

TIME	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	SMIA	STA SV 1	STA SV 2	G	V	E
2400							0099	9567	9646	2158	8396
0000	35634	92022	18016	43016	13506	C831	0093	9568	9613	2158	8382
TOTAL							6	-1	33	—	14

TIME	KVAR	FEEDER 2	FEEDER 5	FEEDER 4	FEEDER 1	FEEDER 3	FEEDER 7	FEEDER 8	FEEDER 9	TOTALIZER
2400	3900	68124	61541	2375	67324	75785	5665	3862	0157	4358
0000	3893	68092	61533	2351	67307	25775	5631	3806	0148	4318
TOTAL	7	32	7	24	17	10	34	56	9	40

MIDNIGHT OPERATOR

Hamilton
DAY OPERATOR

AFTERNOON OPERATOR

BDE FORM 216
1 JUL 84

PREVIOUS EDITION IS OBSOLETE

ELECTRIC POWER PLANT OPERATING LOG

INSTALLATION: Fort Greely, AK. ELECTRICAL GENERATION AND DISTRIBUTION LOG DATE: 16 May 95

	GENERATORS																				KILOWATT DEMAND				FEEDERS										
	UNIT NO. 2					UNIT NO. 3					UNIT NO. 4					UNIT NO. 6 VEE					TOTAL GEN	STATION SERVICE		SDD											BATTERY VOLTAGE
TIME	LOAD KW	LOAD KVAR	AC AMP	P.F. %	TEMP °	LOAD KW	LOAD KVAR	AC AMP	P.F. %	TEMP °	LOAD KW	LOAD KVAR	AC AMP	P.F. %	KV	LOAD KW	LOAD KVAR	AC AMP	P.F. %	TAP		1	2		2	5	4	1	3	9	7	8	KW IN	KVAR IN	
2400	[illegible]														2.4	1400	800	380	.88	6	1488	21	8		75	10	57	51	5	52	45	55	7786	3584	134
0100															2.4	1300	800	360	.88	5	1440	21	16		73	10	51	50	5	45	30	41	7787	3585	134
0200															2.4	1300	800	350	.87	4	1392	21	8		72	10	51	50	5	45	37	34	7787	3585	134
0300															2.4	1300	800	355	.87	4	1392	21	8		73	10	51	50	5	48	35	35	7788	3585	134
0400															2.4	1300	700	340	.88	3	1344	21	8		75	10	51	48	5	48	25	32	7788	3586	134
0500															2.4	1300	700	350	.88	3	1344	22	8		75	10	68	48	5	35	25	37	7789	3586	134
0600															2.4	1500	800	400	.88	4	1536	21	16		88	10	61	58	5	40	25	43	7789	3586	134
0700															2.4	1700	800	450	.90	5	1728	21	10	[redacted]	88	10	61	61	20	40	40	65	7790	3587	134
0800															2.4	2300	1000	580	.93	6	2304	22	16		115	10	82	82	20	40	60	80	7791	3587	134
0900															2.4	2200	900	560	.92	6	2256	22	10		120	10	85	100	25	50	50	65	7792	3588	134
1000															2.4	2400	1000	600	.93	6	2304	22	10		125	10	88	120	22	50	70	65	7793	3588	134
1100	700		1170	9.2	60	650		120	9.3		710		230	93	2.4	0	0	0	0	1	2304	40	25		120	10	88	85	25	48	55	65	7794	3588	134
1200															2.4	0	0	0	0		2352	40	24		120	20	88	95	25	45	50	60	7794	3588	134
1300															2.4	2200	900	580	.93	7	2448	49	24		120	20	88	95	25	45	50	50	7794	3588	134
1400															2.4	2200	900	560	.93	7	2304	38	14		110	10	85	80	20	45	50	50	7795	3589	134
1500															2.4	2200	900	560	.94	7	2352	22	8		140	10	78	85	20	50	60	50	7796	3589	134
1600															2.4	2200	900	560	.93	6	2256	20	7		151	10	90	90	25	48	52	58	7797	3589	134
1700															2.4	1800	900	560	.93	5	[illegible]	20	3	—	103	15	81	72	25	45	70	66	7798	3590	134
1800															2.4	1800	800	490	.92	5	1968	20	5	—	90	15	81	80	5	40	35	79	7798	3590	134
1900															2.4	1800	800	485	.90	5	1920	26	5	—	88	15	72	71	5	40	58	79	7799	3590	134
2000															2.4	1700	800	465	.92	5	1824	20	7	—	82	15	68	73	5	40	33	85	7800	3591	134
2100															2.4	1800	900	455	.90	6	1872	26	7	—	81	15	65	72	5	45	58	78	7801	3591	134
2200															2.4	1600	800	430	.90	6	1728	27	6	—	75	10	58	71	5	35	31	72	7801	3592	134
2300															2.4	1500	800	410	.88	5	1584	21	7	—	78	15	57	62	5	40	33	54	7802	3592	134

TIME	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	SMIA	STA SVC 1	STA SVC 2	G	V	E	[redacted]	KVAR	FEEDER 2	FEEDER 5	FEEDER 4	FEEDER 1	FEEDER 3	FEEDER 7	FEEDER 8	FEEDER 9	[redacted]	TOTALIZER
2400		92003	18003	43036		0931	9881	9589	8224	2158	7803	[redacted]	3592	67016	61243	1549	66685	75362	3752	1765	9830	[redacted]	2942
0000	05634	91990	17991	43024	13506	0831	9875	9589	8184	2158	7786	[redacted]	3584	66983	61232	1524	66662	75357	3712	1706	9820	[redacted]	2899
TOTAL		013	012	12			.6		4.0		.17	[redacted]	8	33	11	25	23	11	40	59	10	[redacted]	43

B. Rosson
MIDNIGHT OPERATOR

Gibson / Hamilton
DAY OPERATOR

[illegible]
AFTERNOON OPERATOR

BDE FORM 216
1 JUL 66

PREVIOUS EDITION IS OBSOLETE

ELECTRIC POWER PLANT OPERATING LOG

INSTALLATION: Fort Greely, AK. ELECTRICAL GENERATION AND DISTRIBUTION LOG DATE: 5 April 95

TIME	Unit No. Load KW	Unit No. Load KVAR	Unit No. AC AMP	Unit No. P.F. %	Unit No. Temp	Unit No. 4 Load KW	Unit No. 4 Load KVAR	Unit No. 4 AC AMP	Unit No. 4 P.F. %	Unit No. 4 Temp	Unit No. Load KW	Unit No. Load KVAR	Unit No. AC AMP	Unit No. P.F. %	KV	Unit No. GVEA Load KW	Unit No. GVEA Load KVAR	Unit No. GVEA AC AMP	Unit No. GVEA P.F. %	Unit No. GVEA TAP	Kilowatt Demand Total Gen	Station Service 1	Station Service 2	SDB	Feeder 2	Feeder 5	Feeder 4	Feeder 1	Feeder 3	Feeder 9	Feeder 7	Feeder 8	KW IN	KVAR IN	Battery Voltage
2400															2.4	1600	800	415	90	5	1621	[illegible]	3	—	72	15	49	51	5	55	50	53	7061	3234	134
0100															2.4	1600	800	420	90	5	1621	[illegible]	4	—	75	15	48	48	5	50	60	52	7068	3235	134
0200															2.4	1500	800	410	90	5	1584	[illegible]	4	—	76	15	49	49	5	51	44	41	7069	3235	134
0300															2.4	1500	800	400	.89	5	1584	[illegible]	5	—	75	10	49	49	5	50	48	41	7069	3235	134
0400															2.4	1500	800	415	.89	5	1584	31	12	—	72	15	48	49	5	60	42	42	7070	3236	134
0500															2.4	1600	900	442	90	6	1680	35	4	—	78	15	52	50	5	61	51	41	7071	3236	134
0600															2.4	1800	800	475	90	7	1872	27	4	—	82	15	55	60	20	68	60	47	7071	3237	134
0700															2.4	1900	800	500	92	7	2064	27	7		91	15	59	69	20	61	56	61	7072	3237	134
0800															2.4	2400	900	640	.94	7	2448	28	8		112	20	70	105	25	60	85	95	7073	3237	134
0900															2.4	2500	900	640	.95	7	2544	28	8		118	30	80	118	50	60	68	75	7074	3238	134
1000															2.4	2600	900	660	.95	7	2592	38	12		120	30	75	110	53	70	80	75	7075	3238	134
1100						900		240	.92						2.4	1700	500	480	.96	5	2640	28	10		125	30	75	105	60	70	75	75	7076	3238	134
1200						850		225	92						2.4	1800	500	480	.96	5	2688	28	18		120	30	90	100	53	70	75	80	7077	3239	134
1300						950		230	93						2.4	1600	500	460	.96	4	2640	36	18		120	30	85	90	50	70	75	75	7078	3239	134
1400						900		240	92						2.4	1700	500	480	.96	4	2640	32	18		120	30	80	85	50	55	65	70	7078	3239	134
1500						750		190	92						2.4	1700	500	420	.95	4	2496	26	16		125	20	75	85	55	60	65	60	7079	3239	134
1600															2.4	2300	900	600	.94	6	2400	26	10		110	20	75	85	55	60	67	76	7080	3240	134
1700															2.4	2100	900	535	.93	6	2088	22	3		100	20	75	85	10	50	43	80	7081	3240	134
1800															2.4	2000	900	520	.92	6	2064	26	3		99	10	70	79	5	50	50	82	7081	3240	134
1900															2.4	1900	800	490	.92	5	2016	26	3		92	10	69	75	5	45	40	85	7082	3241	134
2000															2.4	1800	900	470	.92	5	1920	25	3		90	10	60	69	5	45	40	80	7083	3241	134
2100															2.4	1800	900	470	.93	5	1920	46	3		90	10	58	72	5	49	40	101	7084	3241	134
2200															2.4	1800	900	490	.92	5	1968	26	3		85	10	52	80	5	50	43	95	7085	3242	134
2300															2.4	1800	900	470	.91	5	1872	26	3		80	10	50	62	5	58	50	68	7085	3242	134

TIME	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	SMIA	STA SVC 1	STA SVC 2	G	V	E	KVAR	FEEDER 2	FEEDER 5	FEEDER 4	FEEDER 1	FEEDER 3	FEEDER 7	FEEDER 8	FEEDER 9	TOTALIZER
2400	05579	91977	17937	42978	13447	0831	9616	9607	6506	2158	7086	3242	65793	60847	10637	65835	74887	1894	9315	4398	1225
0000	05579	91944	17937	42946	13447	0831	9619	9608	6451	2158	7067	3234	65769	60835	0613	65811	74873	1840	9250	9387	1177
TOTAL	0	0	0	32	0	0	-3	-1	55	0	19	8	24	12	24	24	14	54	65	11	48

[illegible signature]
MIDNIGHT OPERATOR

Nuttall
DAY OPERATOR

Benson
AFTERNOON OPERATOR

1?? BDE FORM 216 1 JUL 86 PREVIOUS EDITION IS OBSOLETE

ELECTRIC POWER PLANT OPERATING LOG

INSTALLATION: Fort Greely, AK. ELECTRICAL GENERATION AND DISTRIBUTION LOG DATE: 14 Mar. 95

TIME	GENERATORS Unit No. Load KW	Load KVAR	AC AMP	P.F. %	TEMP °	Unit No. Load KW	Load KVAR	AC AMP	P.F. %	TEMP °	Unit No. Load KW	Load KVAR	AC AMP	P.F. %	KV	Unit No. GVEA Load KW	Load KVAR	AC AMP	P.F. %	TAP	KILOWATT DEMAND Total Gen	Station Service 1	Station Service 2	SDD	FEEDERS 2	5	4	1	3	9	7	8			KW IN	KVAR IN	Battery Voltage
2400															2.4	2100	900	540	.93	6	2200	35	18		36	80	50	65	85	65	60	65			6603	3039	134
0100															2.4	2000	900	535	.93	6	2160	36	16		75	40	60	65	5	80	60	70			6604	3040	134
0200															2.4	2000	900	520	.93	6	2112	36	18		72	50	60	65	5	80	55	55			6605	3040	134
0300															2.4	2000	900	520	.92	6	2112	36	16		80	50	60	62	5	80	60	60			6606	3040	134
0400															2.4	2000	900	525	.92	6	2112	36	12		78	50	62	62	5	85	60	62			6607	3041	134
0500															2.4	2200	1000	570	.93	6	2208	37	16		80	50	75	65	5	85	75	60			6608	3041	134
0600															2.4	2300	1000	600	.93	8	2352	37	18		82	50	80	75	5	95	65	70			6609	3042	134
0700															2.4	2700	1100	680	.95	8	2640	38	20		92	55	85	85	40	100	80	80			6610	3042	134
0800						1000		260	.92						2.4	2200	1000	540	.96	4	3400	45	20		120	55	90	100	65	100	90	100			6611	3042	134
0900						1000		260	.93						2.4	2100	1100	530	.96	4	3400	36	20		125	55	95	120	70	100	105	80			6612	3043	134
1000						1080		270	.94						2.4	2200	1100	540	.96	4	3264	36	20		130	55	100	120	70	100	100	70			6612	3043	134
1100						1000		250	.94						2.4	2100	1100	520	.96	4	3168	44	20		125	55	100	120	65	100	100	70			6613	3043	134
1200						1000		250	.94						2.4	2100	1100	530	.96	4	3120	44	20		122	55	100	120	65	90	90	70			6614	3043	134
1300						1000		250	.94						2.4	2200	1100	540	.96	4	3168	36	20		125	55	100	115	65	90	90	75			6615	3043	134
1400						1000		245	.94						2.4	2200	1100	550	.96	4	3140	36	20		128	55	105	120	70	90	85	70			6616	3044	134
1500						1000		250	.94						2.4	2100	1100	540	.96	4	3072	36	20		120	55	100	100	70	90	85	65			6617	3044	134
1600						1000		240	.94						2.4	2000	600	540	.95	4	2980	35	18		122	50	90	102	63	90	90	71			6618	3044	134
1700						950		240	.94						2.4	1700	600	450	.94	4	2712	36	18	-	98	50	88	104	35	85	65	82			6619	3045	134
1800															2.4	2500	1000	640	.94	8	2640	38	12	-	92	51	80	106	30	80	60	80			6619	3045	134
1900															2.4	2600	1100	670	.94	8	2640	36	8	-	90	52	73	102	30	82	70	102			6620	3045	134
2000															2.4	2300	1100	640	.94	8	2592	36	18	-	90	53	65	96	25	90	65	105			6621	3046	134
2100															2.4	2400	1000	630	.94	8	2496	36	16	-	82	50	70	97	20	85	60	110			6622	3046	134
2200															2.4	2300	1000	600	.94	7	2544	36	10	-	86	50	60	90	10	80	62	105			6624	3047	134
2300															2.4	2400	1000	550	.94	7	2352	35	10	-	78	50	66	70	10	80	60	80			6625	3047	134

TIME	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	SMIA	STA SVC 1	STA SVC 2	G	V	E		KVAR	FEEDER 2	FEEDER 5	FEEDER 4	FEEDER 1	FEEDER 3	FEEDER 7	FEEDER 8	FEEDER 9		TOTALIZER
2400	05436	91860	17937	40812	13357	830	9429	9616	5402	2158	6625		3048	65102	60517	00291	65269	74562	0575	7752	9113		0085
2000	05436	91860	17937	40812	13276	830	9449	9616	5349	2158	6603		3039	65067	60497	9998	65257	74544	0503	7687	9098		0025
TOTAL	0	0	0	0	81	0	.10	0	53	0	.22		9	35	20	31	31	18	72	65	15		60

MIDNIGHT OPERATOR	Gerhart Nuttall DAY OPERATOR	Zachgo AFTERNOON OPERATOR

FTED BDE FORM 216 1 JUL 88

PREVIOUS EDITION IS OBSOLETE

ELECTRIC POWER PLANT OPERATING LOG

INSTALLATION: Fort Greely, AK. ELECTRICAL GENERATION AND DISTRIBUTION LOG DATE: 23 Feb 95

TIME	GENERATORS: UNIT NO. LOAD KW	UNIT NO. LOAD KVAR	UNIT NO. AC AMP	UNIT NO. P.F. %	UNIT NO. TEMP.	UNIT NO. LOAD KW	UNIT NO. LOAD KVAR	UNIT NO. AC AMP	UNIT NO. P.F. %	UNIT NO. TEMP.	UNIT NO. LOAD KW	UNIT NO. LOAD KVAR	UNIT NO. AC AMP	UNIT NO. P.F. %	KV	UNIT NO. GVEA LOAD KW	GVEA LOAD KVAR	GVEA AC AMP	GVEA P.F. %	TAP	KILOWATT DEMAND TOTAL GEN	STATION SERVICE 1	STATION SERVICE 2	SAG	FEEDERS 2	5	4	1	3	9	7	8	KW IN	KVAR IN	BATTERY VOLTAGE
2400															2.4	2100	1000	550	.93	4	2208	39	14	–	80	48	60	70	10	90	64	65	6192	2867	134
0100															2.4	1900	1000	550	.92	4	2160	39	10	–	72	50	60	65	10	86	70	68	6193	2867	134
0200														–	2.4	2100	1000	540	.93	4	2160	38	12	–	68	50	58	62	10	82	72	58	6194	2867	134
0300															2.4	2000	1000	530	.92	4	2112	38	10	–	78	50	60	62	10	80	65	55	6195	2868	134
0400															2.4	2000	1000	525	.92	4	2112	39	10	–	72	50	60	62	5	85	62	55	6196	2868	134
0500															2.4	2100	1000	560	.93	5	2160	40	10	–	72	50	60	64	5	100	65	56	6196	2869	134
0600														–	2.4	2200	1000	600	.93	6	2352	40	10	–	80	50	62	80	10	90	86	60	6197	2869	134
0700														–	2.4	2300	1000	650	.94	8	2394	38	10		95	54	78	72	30	100	75	88	6198	2870	134
0800						800		210	94						2.4	2400	800	600	.96	5	3120	44	30		115	65	100	110	60	100	110	100	6199	2870	134
0900						800		210	94						2.4	2400	800	600	.96	6	3168	42	36		120	60	98	125	68	100	90	85	6200	2870	134
1000						840		220	94						2.4	2300	700	600	.96	6	3120	42	30		120	60	100	125	70	100	90	80	6201	2871	134
1100						840		220	94						2.4	2400	700	610	.96	5	3216	42	34		122	60	100	128	70	100	90	75	6202	2871	134
1200						800		210	93						2.4	2300	700	580	.96	5	3120	42	30		120	55	100	125	65	100	90	70	6203	2871	134
1300						800		210	.93						2.4	2400	800	600	.96	5	3168	43	24		125	55	100	115	65	100	95	75	6204	2872	134
1400						800		210	.94						2.4	2300	800	480	.96	.6	3120	42	30		130	50	90	110	70	80	100	75	6205	2872	134
1500						800		210	.94						2.4	2300	800	490	.96	.5	3120	42	20		120	55	100	110	65	85	70	75	6206	2872	134
1600						800		205	94						2.4	2100	700	520	.95	5	2976	41	15		120	50	88	95	62	82	80	78	6207	2872	134
1700						800		205	93						2.4	1900	800	510	.93	5	2736	41	14		91	52	87	103	40	80	81	105	6207	2873	134
1800						780		200	92						2.4	1800	700	460	.93	5	2640	40	16		95	50	78	93	15	81	72	103	6208	2873	134
1900															2.4	2600	1000	650	.94	8	2640	37	9		100	51	88	108	20	80	65	94	6209	2873	134
2000															2.4	2500	1000	635	.94	8	2661	38	8		88	51	70	94	20	80	58	116	6210	2874	134
2100															2.4	2500	1000	645	.94	8	2544	38	8		87	51	63	95	15	50	68	116	6211	2874	134
2200															2.4	2200	1000	610	.93	7	2448	37	7		90	50	59	82	15	78	76	102	6212	2875	134
2300															2.4	2200	1000	560	.93	6	2256	38	8		81	48	63	72	10	80	58	76	6213	2875	134

TIME	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	SMIA	STA SVC 1	STA SVC 2	G	V	E	KVAR	FEEDER 2	FEEDER 5	FEEDER 4	FEEDER 1	FEEDER 3	FEEDER 7	FEEDER 8	FEEDER 9	TOTALIZER
2400	05436	–	–	–	–	0830	9267	–	4416	–	6214	2876	64518	60218	9519	64786	74263	9344	6371	8849	9069
2300	05341	91789	17937	42608	13198	0829	9259	9621	4363	2158	6192	2867	64483	60199	9490	64755	74244	9268	6344	8833	9007
TOTAL	95	–	–	–	–	1	8	–	53	–	22	9	35	19	29	31	19	76	27	16	62

Zachary
MIDNIGHT OPERATOR

Nuttall
DAY OPERATOR

AFTERNOON OPERATOR

1ST BDE FORM 216
1 JUL 66

PREVIOUS EDITION IS OBSOLETE

ELECTRIC POWER PLANT OPERATING LOG

INSTALLATION: Fort Greely, AK. ELECTRICAL GENERATION AND DISTRIBUTION LOG **DATE:** 27 Jan 95

GENERATORS

TIME	UNIT NO. LOAD KW	KVAR	AC AMP	P.F. %	TEMP °	UNIT NO. 2 LOAD KW	KVAR	AC AMP	P.F. %	TEMP °	UNIT NO. 4 LOAD KW	KVAR	AC AMP	P.F. %	KV
2400															2.4
0100															2.4
0200															2.4
0300															2.4
0400															2.4
0500															2.4
0600											1000		250	.94	2.4
0700											1000		250	.94	2.4
0800											1000		250	.95	2.4
0900											1000		250	.94	2.4
1000											1000		250	.95	2.4
1100						700		180	.95		1000		250	.96	2.4
1200						700		180	.95		1000		250	.95	2.4
1300						700		180	.96		1000		250	.95	2.4
1400						700		180	.96		1000		250	.95	2.4
1500						700		130	.95		1000		250	.95	2.4
1600											1000		260	.94	2.4
1700											1000		250	.94	2.4
1800											1000		250	.93	2.4
1900											950		250	.92	2.4
2000													—	—	2.4
2100															2.4
2200															2.4
2300															2.4

TIME	UNIT NO. GVEA LOAD KW	KVAR	AC AMP	P.F. %	TAP	KILOWATT DEMAND CHART TOTALIZER 50	AMPERES STATION SERVICE 1	2	SM 1A
2400	2200	1000	560	.93	6	3304	39	8	
0100	2100	1000	540	.93	6	3304	40	11	
0200	2000	900	520	.93	6	3100	40	10	
0300	2100	900	520	.93	6	3100	40	10	
0400	2100	1000	540	.93	6	3100	[illegible]	10	
0500	2000	1000	530	.93	6	3100	40	10	
0600	1900	1000	540	.93	5	2250	40	14	
0700	1700	700	440	.94	5	2684	39	26	
0800	2300	700	565	.96	6	3168	49	20	
0900	2400	700	600	.96	7	3360	40	20	
1000	2300	700	580	.96	7	3360	47	20	
1100	2600	600	390	.95	3	3408	39	24	
1200	2600	500	400	.96	3	3408	52	25	
1300	2600	500	400	.96	4	3408	47	29	
1400	2500	500	380	.96	4	3312	38	25	
1500	2500	500	390	.96	4	3312	48	25	
1600	2000	600	500	.96	4	3241	40	18	
1700	1800	600	460	.96	4	2880	39	30	
1800	1800	600	460	.95	4	2832	39	23	
1900	1600	600	[illegible]	.94	4	2736	38	31	
2000	2500	1000	610	.95	7	2592	[illegible]	12	
2100	2400	1000	600	.94	7	2496	40	12	
2200	2200	1000	600	.94	7	2400	46	8	
2300	2200	1000	560	.94	7	2304	39	8	

FEEDERS

TIME	2	5	4	1	3	9	7	8			KW IN	KVAR IN	BATTERY VOLTAGE
2400	80	50	60	70	25	85	80	65			5623	2633	134
0100	75	50	55	65	20	80	65	65			5624	2633	134
0200	72	55	55	60	20	80	65	60			5626	2634	134
0300	72	50	53	70	20	80	65	60			5627	2634	134
0400	72	50	55	65	15	90	70	60			5628	2635	134
0500	75	50	52	68	10	90	70	60			5629	2635	134
0600	82	50	65	62	25	95	70	70			5630	2635	134
0700	98	55	60	80	50	100	85	80			5631	2634	134
0800	122	55	80	119	69	100	90	100			5631	2636	134
0900	131	58	85	134	71	105	107	90			5632	2636	134
1000	125	60	90	127	73	100	98	78			5633	2636	134
1100	129	62	99	117	68	105	108	73			5634	2637	134
1200	130	60	92	128	68	95	103	85			5635	2637	134
1300	128	58	95	133	71	95	98	86			5635	2637	134
1400	122	59	100	123	70	100	93	78			5636	2637	134
1500	125	59	95	113	66	95	96	76			5637	2638	134
1600	120	55	91	100	61	105	81	78			5638	2638	134
1700	107	52	77	115	45	90	85	91			5638	2638	134
1800	100	52	80	101	40	81	70	65			5639	2638	134
1900	90	50	78	110	30	80	71	96			5640	2639	134
2000	91	45	77	102	20	80	72	65			5641	2639	134
2100	81	50	68	100	20	79	65	90			5642	2640	134
2200	77	48	63	90	15	78	65	88			5643	2640	134
2300	71	45	62	90	15	72	65	87			5644	2640	134

TIME	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	SMIA	STA SVC 1	STA SVC 2	G	V	E	A	KVAR	FEEDER 2	FEEDER 5	FEEDER 4	FEEDER 1	FEEDER 3	FEEDER 7	FEEDER 8	FEEDER 9		TOTALIZER
2400	—	91614	—	42100	—	—	9043	—	3051	—	5645		2641	63703	59770	8788	64024	73826	7477	4305	8464	/	7568
0000	05737	91580	17937	41987	12621	0853	9034	3627	3003	2155	5625	X	2633	63668	59750	8761	63993	73806	7407	4224	3448	/	7504
TOTAL	—	34	—	113	—	—	9	—	48	—	20		8	35	20	27	31	20	70	81	16	/	54

MIDNIGHT OPERATOR | DAY OPERATOR | AFTERNOON OPERATOR

172D BDE FORM 216
1 JUL 84

PREVIOUS EDITION IS OBSOLETE

ELECTRIC POWER PLANT OPERATING LOG

INSTALLATION: Fort Greely, AK. ELECTRICAL GENERATION AND DISTRIBUTION LOG DATE: 7 DEC 94

TIME	GENERATORS Unit No. 1 Load KW	Unit No. 1 Load KVAR	Unit No. 1 AC AMP	Unit No. 1 P.F. %	Unit No. 1 TEMP	Unit No. 4 DC Load KW	Unit No. 4 DC Load KVAR	Unit No. 4 DC AC AMP	Unit No. 4 DC P.F. %	Unit No. 4 DC TEMP	Unit No. Load KW	Unit No. Load KVAR	Unit No. AC AMP	Unit No. P.F. %	KV	Unit No. GVEA Load KW	Unit No. GVEA Load KVAR	Unit No. GVEA AC AMP	Unit No. GVEA P.F. %	TAP	KILOWATT DEMAND Total Gen	Station Service 1	Station Service 2	SDO	FEEDERS 2	5	4	1	3	9	7	8	KW IN	KVAR IN	BATTERY VOLTAGE
2400															2.4	2300	1000	540	.93	6	2440	37	8		75	50	68	80	15	90	90	75	4532	2177	134
0100															2.4	2200	1000	550	.93	6	2256	40	8		80	50	62	80	15	90	70	60	4533	2178	134
0200															2.4	2100	1000	540	.93	5	2160	40	8		76	50	62	66	10	90	70	60	4534	2179	134
0300															2.4	2000	1000	530	.93	5	2160	40	8		78	50	60	58	15	85	70	55	4534	2179	134
0400															2.4	2100	1000	550	.93	5	2112	40	8		78	50	65	68	15	90	70	65	4535	2179	134
0500															2.4	2200	1000	560	.94	5	2160	40	8		78	48	72	72	25	100	66	55	4536	2180	134
0600															2.4	2400	1000	625	.94	6	2352	41	8		92	50	77	75	20	95	80	71	4537	2180	134
0700						750		210	.91						2.4	1500	700	475	.95	3	2610	40	20		91	55	90	57	45	98	90	76	4538	2181	134
0800						950		245	.93						2.4	2100	700	535	.93	4	3072	40	18		120	55	92	103	60	100	105	84	4539	2181	134
0900						950		245	.95						2.4	2200	700	560	.95	5	3168	40	18		120	58	90	103	65	105	93	95	4540	2181	134
1000						950		240	.95						2.4	2400	800	610	.95	7	3264	47	24		122	55	97	108	81	100	110	98	4541	2181	134
1100						850		215	.95						2.4	2500	800	610	.95	7	3312	39	18		120	55	103	108	75	106	92	105	4542	2182	134
1200	900		220	.95		1050		260	.95						2.4	2500	500	370	.95	1	3456	39	18		122	60	100	125	85	130	112	100	4543	2182	134
1300	850		200	.95		1000		250	.95						2.4	2600	600	380	.94	4	3360	46	18		125	60	98	112	74	103	95	100	4543	2182	134
1400	900		220	.95		1000		245	.95						2.4	1500	500	360	.95	4	3408	44	18		125	58	98	116	70	95	105	88	4544	2183	134
1500						1000		255	.95						2.4	2200	700	550	.95	5	3312	38	24		122	55	103	110	71	100	95	94	4545	2183	134
1600						1000		255	.95						2.4	2200	800	560	.95	6	3360	40	18		122	60	100	110	70	100	90	110	4546	2183	134
1700						1000		255	.95						2.4	2000	700	500	.94	5	[illegible]	40	18		100	55	82	115	60	90	80	115	4547	2183	134
1800						1000		255	.95						2.4	2000	700	540	.94	5	3120	40	16		95	52	90	125	50	90	85	120	4547	2184	134
1900						1000		255	.95						2.4	2000	700	460	.94	5	3072	48	16		90	52	92	120	50	90	70	115	4548	2184	134
2000						1000		255	.95						2.4	1800	700	450	.94	5	3024	40	20		90	55	80	115	50	85	85	115	4549	2184	134
2100															2.4	2200	1100	690	.95	8	2352	47	10		90	55	70	128	48	90	80	115	4550	2185	134
2200															2.4	2500	1000	650	.95	7	2256	40	18		90	50	68	103	25	85	75	100	4551	2185	134
2300															2.4	2300	1000	600	.94	6	2496	40	14		75	50	62	80	30	85	70	80	4552	2185	134

TIME	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	SMIA	STA SVC 1	STA SVC 2	G	V	E	KVAR	FEEDER 2	FEEDER 5	FEEDER 4	FEEDER 1	FEEDER 3	FEEDER 7	FEEDER 8	FEEDER 9	TOTALIZER
2400				40951			8588	9639	0433	2158	4553	2156	62172	58934	74377	60566	72947	3690	02414	7791	4653
2000	0478	91236	17937	40963	11457	0824	8579	9639	0380	2158	4532	2177	62137	58928	7465	60555	72925	3605	0155	7694	4585
TOTAL				12			8	-	53	-	21	9	40	20	22	31	22	5	89	100	68

Benson MIDNIGHT OPERATOR

Benson DAY OPERATOR

AFTERNOON OPERATOR

FTGD 3DE FORM 216 1 JUL 84

PREVIOUS EDITION IS OBSOLETE

ELECTRIC POWER PLANT OPERATING LOG

INSTALLATION: Fort Greely, AK. ELECTRICAL GENERATION AND DISTRIBUTION LOG DATE: 30 Nov 94

GENERATORS

TIME	UNIT NO. LOAD KW	KVAR	AC AMP	P.F. %	TEMP °	UNIT NO. LOAD KW	KVAR	AC AMP	P.F. %	TEMP °	UNIT NO. 1 LOAD KW	KVAR	AC AMP	P.F. %	KV	UNIT NO. GVEA LOAD KW	KVAR	AC AMP	P.F. %	TAP
2400														+	2.4	2100	1000	545	.93	5
0100														+	2.4	2000	1000	525	.92	4
0200														+	2.4	2000	1000	525	.92	5
0300														+	2.4	2000	1000	525	.92	5
0400														+	2.4	2000	1000	520	.92	5
0500														+	2.4	2100	1000	550	.92	5
0600														+	2.4	2200	1000	570	.93	6
0700															2.4	2500	1000	645	.94	7
0800											900		230	.95	2.4	2100	700	520	.95	4
0900											900		230	.95	2.4	2200	700	530	.95	4
1000										#406	900		230	.95	2.4	2100	700	530	.95	4
1100											1100		240	.95	2.4	2200	700	550	.96	4
1200											1100		280	.96	2.4	2200	700	540	.96	4
1300											1100		220	.95	2.4	2100	700	510	.95	4
1400											1100		290	.95	2.4	2100	700	520	.95	4
1500											1100		290	.95	2.4	2200	700	540	.95	4
1600											1100		285	.93	2.4	2200	600	535	.96	4
1700											1100		285	.94	2.4	1800	600	465	.95	4
1800											1050		275	.93	2.4	1800	600	460	.95	4
1900											1050		270	.94	2.4	1800	600	460	.95	4
2000											1050		270	.93	2.4	1800	600	410	.95	4
2100											1050		270	.93	2.4	1600	600	395	.94	4
2200															2.4	2600	1000	625	.94	6
2300															2.4	2300	1000	590	.94	6

FEEDERS

TIME	KILOWATT DEMAND CHART TOTALIZER		AMPERES STATION SERVICE 1	2	SM 1A	2	5	4	1	3	9	7	8			KW IN	KVAR IN	BATTERY VOLTAGE
2400	2204		39	8		80	48	62	69	20	80	70	63			4380	2118	134
0100	2112		40	8		76	48	61	63	20	85	72	57			4380	2118	134
0200	2064		40	9		74	48	61	63	20	80	71	57			4381	2118	134
0300	2016		40	17		78	48	60	65	15	75	63	55			4382	2119	134
0400	2016		40	9		76	48	62	62	20	85	61	53			4383	2119	134
0500	2160		40	9		76	48	71	67	20	85	75	52			4384	2117	134
0600	2256		40	10		84	48	73	67	20	90	63	65			4385	2120	134
0700	2592		40	10		87	50	81	79	48	95	76	76			4386	2120	134
0800	2976		40	16		112	52	96	110	58	90	85	90			4387	2121	134
0900	3168		40	16		125	52	96	120	62	100	100	75			4388	2121	134
1000	3216		49	20		122	52	86	120	75	95	85	65			4387	2121	134
1100	3312		40	20		130	52	100	120	88	115	115	75			4389	2122	134
1200	3360		40	26		125	55	100	120	80	100	90	72			4390	2122	134
1300	3264		39	20		110	50	110	118	78	95	115	60			4391	2122	134
1400	3312		39	26		130	55	110	112	78	100	90	70			4392	2123	134
1500	3264		46	24		130	52	100	110	78	100	100	75			4393	2123	134
1600	3216		40	19		121	53	110	110	80	100	100	70			4394	2123	134
1700	2928	X	48	20		105	52	90	110	52	95	80	80			4395	2123	134
1800	2880	X	39	22		98	52	82	112	35	92	76	115			4395	2123	134
1900	2880	X	48	18		93	52	87	112	30	90	68	112			4396	2124	134
2000	2904	X	48	19		90	60	70	111	20	90	58	117			4397	2124	134
2100	2688	X	48	24		98	52	71	108	20	90	65	92			4398	2124	134
2200	2496	X	39	14		88	52	68	101	15	83	63	96			4399	2125	134
2300	2352	X	48	14		78	51	70	82	15	83	66	76			4400	2125	134

TIME	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	SMIA	STA SVC 1	STA SVC 2	G	V	E	A	KVAR	FEEDER 2	FEEDER 5	FEEDER 4	FEEDER 1	FEEDER 3	FEEDER 7	FEEDER 8	FEEDER 9		TOTALIZER
2400	04648	–	–	46863	–	–	8522	9640	0068	–	4401		2126	61949	58812	7224	62354	72821	3156	9676	7605	X	4228
2300	04615	91120	17937	40765	11212	0894	8512	9641	0017	2158	4380	X	2118	61913	58792	7191	62322	72801	3079	9596	7589		4163
TOTAL	33	–	–	98	–	–	.10	-1	51	–	21	–	8	36	20	33	32	20	77	80	16		65

MIDNIGHT OPERATOR DAY OPERATOR AFTERNOON OPERATOR

172D BDE FORM 216
1 JUL 88

PREVIOUS EDITION IS OBSOLETE

ELECTRIC POWER PLANT OPERATING LOG

INSTALLATION: Fort Greely, AK. ELECTRICAL GENERATION AND DISTRIBUTION LOG **DATE:** 27 OCT 94

TIME	GENERATORS Unit No. Load KW	Load KVAR	AC AMP	P.F. %	TEMP	Unit No. 5 Load KW	Load KVAR	AC AMP	P.F. %	TEMP	Unit No. Load KW	Load KVAR	AC AMP	P.F. %	KV	Unit No. GVEA Load KW	Load KVAR	AC AMP	P.F. %	TAP	Kilowatt Demand Chart Totalizer		Amperes Station Service 1	2	8M 1A	Feeders 2	5	4	1	3	9	7	8			KW IN	KVAR IN	Battery Voltage
2400														✓	2.4	1800	900	465	.91	5	1872		42	6		80	25	49	60	5	65	60	66			3655	1814	134
0100														✓	2.4	1600	800	435	.90	4	1824		34	6		79	25	48	58	5	65	50	53			3656	1815	134
0200														✓	2.4	1600	800	420	.90	4	1680		33	7		79	25	48	53	5	65	43	45			3657	1815	134
0300														✓	2.4	1600	800	415	.90	4	1728		33	6		79	20	48	56	5	65	45	45			3657	1815	134
0400														✓	2.4	1600	800	415	.90	4	1632		33	7		81	20	49	51	5	60	50	42			3658	1816	134
0500														✓	2.4	1700	900	465	.90	5	1776		33	6		78	30	51	52	5	65	71	47			3659	1816	134
0600														✓	2.4	1800	900	483	.92	5	1920		32	14		75	30	55	58	5	70	51	56			3659	1817	134
0700															2.4	2300	1000	610	.93	8	2256		39	9		88	30	62	81	35	75	80	84			3660	1817	134
0800															2.4	2600	600	690	.94	8	2592		31	14		118	30	71	102	62	75	65	95			3661	1817	134
0900						1000	X	335	93	X					2.4	1700	600	460	.92	2	2064		32	15		120	40	87	108	63	80	92	75			3662	1818	134
1000						1000	X	350	93	X					2.4	1600	500	425	.94	1	2064		31	20		121	40	77	120	67	75	68	59			3663	1818	134
1100						1000	X	355	93	X					2.4	1600	500	435	.94	1	2064		29	20		118	40	73	112	63	75	97	53			3664	1818	134
1200						1000	X	350	93	X					2.4	1600	500	425	.94	1	2016		28	20		110	40	79	100	61	70	68	66			3664	1818	134
1300						1000	X	350	93	X					2.4	1600	500	415	.94	2	2640		31	24		117	35	78	99	60	75	68	64			3665	1819	134
1400						1000	X	350	93	X					2.4	1600	500	415	.94	2	2544		40	19		112	30	79	100	66	72	70	62			3666	1819	134
1500						1000	X	350	93	X					2.4	1500	500	390	.94	2	2544		32	20		110	25	81	90	63	68	71	65			3666	1819	134
1600															2.4	2500	1000	640	.95	7	2496		32	8		112	30	75	90	60	70	75	72			3668	1820	134
1700															2.4	[illegible]	1000	[illegible]	.93	7	[illegible]		42	8		92	30	78	92	40	75	70	80			3669	1820	134
1800														-	2.4	[illegible]	[illegible]	[illegible]	[illegible]	7	[illegible]		32	8		92	30	[illegible]	95	30	70	54	92			[illegible]	[illegible]	134
1900															2.4	[illegible]	[illegible]	[illegible]	[illegible]	7	[illegible]		32	5		90	40	70	[illegible]	25	65	57	98			[illegible]	1821	134
2000															2.4	[illegible]	[illegible]	[illegible]	.92	6	[illegible]		31	3		90	40	58	40	25	70	50	95			3672	1821	134
2100															2.4	[illegible]	[illegible]	550	.92	6	[illegible]		32	10		90	40	52	82	20	60	45	55			3672	1821	134
2200															2.4	2000	900	525	.92	6	[illegible]		32	18		90	25	50	80	20	60	45	50			3673	1822	134
2300														-	2.4	[illegible]	[illegible]	500	.91	5	[illegible]		40	8		85	30	50	65	70	60	70	70			3674	1822	136

TIME	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	SMIA	STA SVC 1	STA SVC 2	G	V	E	A	KVAR	FEEDER 2	FEEDER 5	FEEDER 4	FEEDER 1	FEEDER 3	FEEDER 7	FEEDER 8	FEEDER 9		TOTALIZER
2400					11067		3215	9649	8328		3675		1823	60909	58286	6394	61412	72263	1074	7089	7134		2407
0000	04412	90747	17743	40737	11012	0822	3206	7650	8282	2158	3655		1814	60875	58272	6371	61385	72245	1018	7020	7121		2356
TOTAL					55		9	-1	46		20		9	34	14	23	27	18	56	69	13		51

Goodw[illegible]
MIDNIGHT OPERATOR

DAY OPERATOR

Zachar[illegible]
AFTERNOON OPERATOR

172D BDE FORM 216
1 JUL 84

PREVIOUS EDITION IS OBSOLETE

ELECTRIC POWER PLANT. OPERATING LOG

INSTALLATION: FORT GREELY, AK. ELECTRICAL GENERATION AND DISTRIBUTION LOG DATE: 14 SEPT 94

GENERATORS

TIME	UNIT NO. #4 LOAD KW	KVAR	AC AMP	P.F. %	TEMP °	UNIT NO. #2 LOAD KW	KVAR	AC AMP	P.F. %	TEMP °	UNIT NO. LOAD KW	KVAR	AC AMP	P.F. %	KV	UNIT NO. GVEA LOAD KW	KVAR	AC AMP	P.F. %	TAP
2400															2.4	1400	800	390	.87	5
0100															2.4	1400	800	380	.87	5
0200															2.4	1300	800	350	.87	5
0300															2.4	1200	800	340	.86	5
0400															2.4	1200	800	345	.87	5
0500															2.4	1200	800	345	.87	5
0600														–	2.4	1500	800	400	.90	5
0700														–	2.4	1400	800	500	.91	6
0800															2.4	2100	900	545	.93	7
0900															2.4	2200	900	570	.94	7
1000	1000		260	.94											2.4	1300	500	315	.93	3
1100	1100		280	.90											2.4	1300	400	310	.94	3
1200	1000		265	.91											2.4	1300	400	320	.93	3
1300	0					850		220	.93						2.4	1400	500	380	.93	3
1400						875		235	.71						2.4	1900	500	380	.94	3
1500						875		230	.99						2.4	1400	400	375	.94	3
1600															2.4	[illegible]	900	555	.93	8
1700															2.4	2000	900	540	.92	7
1800															2.4	[illegible]	900	570	.93	7
1900															2.4	[illegible]	[illegible]	[illegible]	.93	7
2000															2.4	1400	800	450	.87	6
2100															2.4	1400	800	[illegible]	.90	7
2200															2.4	1600	800	430	.89	6
2300															2.4	1500	800	400	.86	5

KILOWATT DEMAND / FEEDERS

TIME	TOTAL GEN	STATION SERVICE 1	STATION SERVICE 2	SOO	2	5	4	1	3	9	7	8			KW IN	KVAR IN	BATTERY VOLTAGE
2400	1440	25	3		78	20	45	52	5	40	43	42			2878	1446	134
0100	1440	26	3		80	20	30	58	5	40	46	38			2879	1446	134
0200	1392	26	3		73	15	30	58	5	40	30	38			2879	1446	134
0300	1344	26	13		80	15	30	50	5	25	32	34			2880	1447	134
0400	1344	26	3		76	15	30	48	5	20	32	32			2880	1447	134
0500	1344	25	3		80	15	40	50	5	35	30	36			2881	1447	134
0600	1488	26	3		86	15	50	54	10	40	30	48			2881	1448	134
0700	1920	25	8		98	20	70	65	40	48	50	62			2882	1448	134
0800	2160	32	5		117	20	67	91	40	40	45	75			2883	1448	134
0900	2256	26	10		115	20	72	91	53	45	57	61			2884	1449	134
1000	2352	32	18		118	20	72	105	58	45	60	67			2895	1449	134
1100	2352	27	18		120	20	85	105	55	40	50	70			2885	1449	134
1200	2448	27	18		112	20	79	98	48	40	50	63			2886	1449	134
1300	2352	44	15		120	20	62	98	53	45	48	48			2886	1450	134
1400	2352	36	16		122	25	80	91	53	40	72	46			2887	1450	134
1500	2304	36	13		119	25	80	88	53	40	52	55			2887	1450	134
1600	[illegible]	[illegible]	15		115	20	78	75	60	40	55	62			2888	1451	134
1700	[illegible]	[illegible]	3		110	20	72	90	45	[illegible]	45	70			2889	1451	134
1800	[illegible]	[illegible]	3		[illegible]	10	60	77	10	10	[illegible]	70			[illegible]	1451	134
1900	[illegible]	[illegible]	3		[illegible]	10	60	70	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	1452	[illegible]
2000	[illegible]	[illegible]	16		[illegible]	10	55	[illegible]	[illegible]	10	30	70			2891	1452	[illegible]
2100	[illegible]	[illegible]	3		[illegible]	10	[illegible]	80	5	[illegible]	30	30			2892	1452	[illegible]
2200	[illegible]	[illegible]	3		[illegible]	10	30	70	5	40	30	75			2893	1453	134
2300	1632	26	6		80	10	30	65	5	35	55	64			2893	1453	134

TIME	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	SMIA	STA SVC 1	STA SVC 2	G	V	E		KVAR	FEEDER 2	FEEDER 5	FEEDER 4	FEEDER 1	FEEDER 3	FEEDER 7	FEEDER 8	FEEDER 9		TOTALIZER
2400		90715		40663			7905	9668	6457	2158	2854		[illegible]	59664	57850	5479	60452	71704	9072	4241	6655		0530
0300	94388	90724	17647	40634	10915	6817	7898	9661	6419	2158	2878		1446	59571	57837	5458	60430	71690	9031	4283	6645		0487
TOTAL		21		29			7	–	38	—	16		7	33	9	21	22	14	42	58	10		43

MIDNIGHT OPERATOR	DAY OPERATOR	AFTERNOON OPERATOR
Zachgo	Benson / SHANKLE	[illegible]

172D BDE FORM 216, 1 JUL 84

PREVIOUS EDITION IS OBSOLETE

ELECTRIC POWER PLANT-OPERATING LOG

INSTALLATION: Fort Greely, AK. ELECTRICAL GENERATION AND DISTRIBUTION LOG DATE: 29 Aug 94

GENERATORS

TIME	UNIT NO. LOAD KW	KVAR	AC AMP	P.F. %	TEMP	UNIT NO. LOAD KW	KVAR	AC AMP	P.F. %	TEMP	UNIT NO. LOAD KW	KVAR	AC AMP	P.F. %	KV	UNIT NO. GVEA LOAD KW	KVAR	AC AMP	P.F. %	TAP
2400															2.4	1400	800	360	.87	5
0100															2.4	1400	800	340	.88	5
0200															2.4	1200	700	320	.86	5
0300															2.4	1200	700	330	.86	5
0400															2.4	1300	800	350	.87	5
0500															2.4	1200	700	330	.87	5
0600															2.4	1400	700	370	.88	6
0700															2.4	1500	800	410	.91	7
0800															2.4	2000	800	535	.93	8
0900															2.4	2100	800	555	.94	8
1000															2.4	2200	800	590	.94	8
1100															2.4	2100	800	565	.94	8
1200															2.4	2200	800	560	.95	8
1300															2.4	2100	800	560	.94	7
1400															2.4	2100	800	560	.94	7
1500															2.4	2000	800	525	.94	7
1600														✓	2.4	2000	800	515	.94	6
1700														✓	2.4	1900	800	480	.94	5
1800														✓	2.4	1700	800	445	.91	5
1900														✓	2.4	1600	800	430	.89	5
2000														✓	2.4	1600	800	420	.90	5
2100														✓	2.4	1600	800	415	.90	5
2200														✓	2.4	1600	800	420	.90	5
2300														✓	2.4	1400	800	385	.89	5

KILOWATT DEMAND / FEEDERS

TIME	TOTAL GEN	STATION SERVICE 1	2	SDM	2	5	4	1	3	9	7	8			KW IN	KVAR IN	BATTERY VOLTAGE
2400	1486	28	3		88	5	40	50	5	20	35	48			2614	1311	134
0100	1392	23	3		80	5	35	50	5	25	45	40			2614	1312	134
0200	1393	22	3		80	5	25	50	5	25	30	35			2615	1312	134
0300	1248	22	3		76	5	25	50	5	25	30	30			2615	1312	134
0400	1248	22	3		80	5	30	50	5	25	50	35			2616	1312	134
0500	1344	22	3		80	5	40	50	5	25	20	35			2616	1313	134
0600	1392	28	10		82	5	50	50	5	25	30	45			2617	1313	134
0700	1584	28	6		78	5	60	65	10	25	53	70			2618	1313	134
0800	2064	34	20		110	10	65	100	30	30	40	67			2619	1314	134
0900	2160	21	5		112	5	71	91	40	35	53	58			2619	1314	134
1000	2256	[illegible]	4		112	5	79	100	48	40	73	64			2620	1315	134
1100	2208		4		110	10	79	100	48	35	57	65			2621	1315	134
1200	2256	22	4		120	10	88	111	45	20	52	53			2621	1315	134
1300	2257	28	5		120	10	72	91	45	25	51	55			2623	1316	134
1400	2160	20	5		115	10	75	78	49	25	51	58			2624	1316	134
1500	2112	21	3		120	10	72	72	49	30	53	57			2625	1316	134
1600	2160	22	4		118	15	74	72	50	20	52	65			2626	1317	134
1700	2064	21	4		100	10	61	71	48	20	45	70			2626	1317	134
1800	1872	28	5		38	10	58	75	5	15	33	84			2627	1317	134
1900	1776	21	3		42	10	54	73	5	10	30	70			2628	1318	134
2000	1632	22	11		82	15	45	67	5	20	30	82			2629	1318	134
2100	1680	29	2		85	15	45	64	5	10	30	82			2629	1318	134
2200	1584	21	2		83	15	48	69	5	20	25	77			2630	1319	134
2300	1632	22	3		81	15	48	61	5	30	25	56			2631	1319	134

TIME	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	SMIA	STA SVC 1	STA SVC 2	G	V	E	A	KVAR	FEEDER 2	FEEDER 5	FEEDER 4	FEEDER 1	FEEDER 3	FEEDER 7	FEEDER 8	FEEDER 9		TOTALIZER
2400	04374	90724	17647	40634	10715	0817	[illegible]	9672	5827	2158	2631		1319	59123	57713	5170	60136	71519	8464	3425	6492		9903
0000	04374	90724	17647	40634	10915	0817	7805	9672	5786	2156	2614		1311	59090	57704	5149	60114	71506	8424	3367	6483		9862
TOTAL	0	0	0	0	0	0	.5	0	4.1	0	.17		8	.33	9	21	22	13	40	58	9		41

MIDNIGHT OPERATOR DAY OPERATOR AFTERNOON OPERATOR

172D BDE FORM 216 1 JUL 84

PREVIOUS EDITION IS OBSOLETE.

ELECTRIC POWER PLANT OPERATING LOG

INSTALLATION: FORT GREELY, AK. ELECTRICAL GENERATION AND DISTRIBUTION LOG DATE: 21 JULY 94

GENERATORS

TIME	UNIT NO. 5 LOAD KW	UNIT NO. 5 LOAD KVAR	UNIT NO. 5 AC AMP	UNIT NO. 5 P.F. %	UNIT NO. 5 TEMP °	UNIT NO. LOAD KW	UNIT NO. LOAD KVAR	UNIT NO. AC AMP	UNIT NO. P.F. %	UNIT NO. TEMP °	UNIT NO. LOAD KW	UNIT NO. LOAD KVAR	UNIT NO. AC AMP	UNIT NO. P.F. %	KV	UNIT NO. GVEA LOAD KW	UNIT NO. GVEA LOAD KVAR	UNIT NO. GVEA AC AMP	UNIT NO. GVEA P.F. %	TAP	KILOWATT DEMAND TOTAL GEN	STATION SERVICE 1	STATION SERVICE 2	SOO
2400															24	1300	700	365	.87	5	1892	21	13	X
0100															24	1200	700	335	.87	5	1946	25	12	X
0200															24	1200	700	330	.86	5	1848	25	3	X
0300															2.4	1200	700	335	.85	5	1848	26	12	X
0400															2.4	1200	700	335	.85	5	1848	26	3	X
0500															24	1200	700	330	.85	5	1800	31	12	X
0600															24	1300	700	360	.88	5	1944	32	3	X
0700															24	1600	700	420	.90	6	1632	25	12	
0800															2.4	1900	800	495	.93	7	1872	26	3	
0900															2.4	2000	900	570	.92	8	1920	34	14	
1000	1000		270	.90											2.4	1000	400	240	.91	4	2016	26	12	
1100	1000		270	.91											2.4	1000	400	300	.92	4	2112	26	16	
1200	1000		270	.91											2.4	1200	400	310	.93	4	2256	26	18	
1300	1000		270	.91											2.4	1200	400	305	.91	5	2112	34	30	
1400	1000		270	.91											2.4	1200	500	305	.91	5	2112	26	20	
1500															2.4	2400	900	553	.92	9	2112	33	24	
1600															2.4	2100	1000	550	.92	8	2160	32	3	
1700															2.4	1900	800	510	.91	8	2112	32	18	
1800															2.4	1600	700	420	.90	8	1824	32	20	
1900															2.4	1600	700	420	.90	7	1728	32	3	
2000															2.4	1600	700	420	.89	7	1632	20	18	
2100															2.4	1400	700	370	.88	6	1536	26	5	
2200															2.4	1400	500	330	.87	5	1488	32	3	
2300															2.4	1300	800	330	.87	5	1440	23	3	

FEEDERS

TIME	2	5	4	1	3	9	7	8			KW IN	KVAR IN	BATTERY VOLTAGE
2400	78	5	25	48	5	25	46	55			2031	1004	134
0100	79	5	25	48	5	15	31	35			2031	1004	134
0200	75	5	20	40	5	25	30	35			2032	1004	134
0300	86	5	20	46	5	20	32	31			2032	1005	134
0400	82	5	20	46	5	15	38	33			2033	1005	134
0500	78	5	20	46	5	15	28	31			2033	1005	134
0600	80	5	48	45	5	15	30	47			2034	1006	134
0700	98	5	57	50	5	35	43	40			2034	1006	134
0800	113	5	71	58	40	45	50	45			2035	1006	134
0900	113	5	71	56	45	40	60	50			2036	1007	134
1000	113	10	71	65	45	35	62	47			2037	1007	134
1100	118	10	85	80	60	35	60	60			2037	1007	134
1200	113	10	83	70	60	25	62	75			2038	1007	134
1300	118	10	80	73	45	35	60	60			2038	1007	134
1400	118	10	78	87	50	40	77	55			2039	1008	134
1500	120	10	80	70	50	35	57	65			2039	1008	134
1600	118	5	85	70	50	30	75	50			2040	1008	134
1700	110	5	70	75	45	15	45	70			2041	1009	134
1800	93	5	65	65	5	10	55	70			2042	1009	134
1900	90	5	60	70	5	5	30	70			2043	1009	134
2000	72	5	45	68	5	5	45	75			2043	1010	134
2100	72	5	45	65	5	-	30	70			2044	1010	134
2200	70	5	25	60	5	5	30	65			2044	1010	134
2300	79	5	25	60	5	5	30	55			2045	1011	134

TIME	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	SMIA	STA SVC 1	STA SVC 2	G	V	E	A	KVAR	FEEDER 2	FEEDER 5	FEEDER 4	FEEDER 1	FEEDER 3	FEEDER 7	FEEDER 8	FEEDER 9		TOTALIZER
2400					10874		7595	9105	4424	-	2045		1011	57922	57444	44437	59517	71085	7084	1410	6183		8503
0000	24349	90724	17628	40560	10837	0814	7589	9106	4389	2158	2031		1004	57888	57440	44416	59561	71072	7044	1358	6175		8464
TOTAL					37	-	6	-1	35	-	14		7	34	+	21	16	13	40	54	8		39

MIDNIGHT OPERATOR

Benson
DAY OPERATOR

AFTERNOON OPERATOR

172D BDE FORM 216
1 JUL 88

PREVIOUS EDITION IS OBSOLETE

ELECTRIC
OPERATING LOG

JULY 95

DAY______ MONTH______ 19____

POSITION	OPERATORS 12-8 SHIFT	8-4 SHIFT	4-12 SHIFT
ENGINES	PRESENT	O/H HRS	HRS SI[illegible]
1	72805	71652	1153[illegible]
2	83684	77849	5835
3	86043	77002	9041
4	55735.4	49188	6547.4
5	50657.6	46787	3870.6

DATE | TIME (Hour) | ENTRIES

ENGINE KW METERS

MULT	PRESENT	PREVIOUS	DIFF	TOTAL
1 X 100	05665	05665	0	0
2 X 100	92060	92046	14	1,400
3 X 100	18024	18019	5	500
4 X 114.3	43164	43096	68	7,772.4
5 X 114.3	13546	13527	19	2,171.7

ENGINE (← HOURS →)	PRESENT	PREVIOUS	RUN	STDBY
1	72805	72805	0	744
2	83684	83682	2	742
3	86043.5	86043	0 ½	744
4	55735.4	55722.5	12.9	731.1
5	50657.6	50653.7	3.9	740.1

METERS		PRESENT	PREVIOUS	DIFF	TOTAL
GVEA POLE	X 1	4093	3857	236	566,400
KwHr	d X 2	8951	8502	449	1,077,600
KwHr	r 4	0	0	0	0
Kvar	d 0 0	4199	3956	243	583,200
Kvar	r	0	0	0	0
G	BOARD IN X1000	0977	9901	1076	1,076,000
V	BOARD OUT X1000	2158	2158	0	0

FEEDERS

No	MULT	PRES	PREV	DIFF
1	100	67870	67431	43900
2	106	69202	68328	87,400
3	106	76163	75860	30,300
4	100	3123	2522	60,100
5	100	61796	61591	20,500
7	100	6275	5297	97,800
8	100	5831	4222	160,900
9	100	0479	0212	26,700
SS/1	100	0304	0140	16,400
SS/2	100	9545	9564	-1,900
OH/TIE	100	0002	0002	0
SM/1A	300	0831	0831	0
TOTAL	1000	5685	4612	1,073,000

FUEL	PRESENT	PREVIOUS	USED
1-2-3	986963	986681	282
4-5	317310	316370	940
		TOTAL →	1,222

MAX	KW	TIME	DATE
POST	2256	1500	5 JULY 1995
GVEA	2200	1800	5 JULY 1995

PEAK KW DEMAND IN .91 X 2400 = 2184

~~#3 DG O/L for GEAR REPAIRS 26 JULY 95~~

ENGINE OIL USED

1	2	3	4	5	TOTAL
½	½	1	1	1	4 GAL

ENGINE DAYS RUN

1	2	4	7	3	17 DA

HEATING DEGREE DAYS [illegible]

OPERATOR GIBSON

[illegible] and initial all errors. REVIEWED - Signature of Supervisor [illegible]

ELECTRIC
OPERATING LOG

JUNE 95

DAY______ MONTH______ 19______

POSITION	OPERATORS 12-8 SHIFT	8-4 SHIFT	4-12 SHIFT
ENGINES	PRESENT	O/H HRS	HRS SINCE
1	72805	71652	1153
2	83682	77849	5833
3	86043	77002	9041
4	55722.5	49188	6534.5
5	50653.7	46787	3866.7

DATE[1] TIME (Hour) ENTRIES

ENGINE KW METERS

MULT	PRESENT	PREVIOUS	DIFF	TOTAL
1 X100	05665	05634	31	3100
2 X100	92046	92022	24	2400
3 X100	18019	18003	6	600
4 X114.3	43096	43076	20	2286.0
5 X114.3	13527	13478	49	5600.7

ENGINE	PRESENT	PREVIOUS	RUN	STDBY
1	72805	72801	4	716
2	83682	83677	5	715
3	86043	86040	3	717
4	55722.5	55719.5	3	717
5	50653.7	50647.2	6.5	713.5

HOURS

METERS	PRESENT	PREVIOUS	DIFF	TOTAL
GVEA POLEX 1	3857	3632	205	492,000
KwHr d X2	8502	8045	457	1,096,800
KwHr r 4	0	0	0	0
Kvar d 0	3956	3715	241	578,400
Kvar r 0	0	0	0	0
G BOARD IN X1000	9901	8806	1095	1095,000
V BOARD OUT X1000	2158	2158	0	0

FEEDERS

No	MULT	PRES	PREV	DIFF
1	100	67431	66968	46300
2	100	68328	67444	88400
3	100	75860	75540	32000
4	100	2522	1185	133,700
5	100	61591	61387	20400
7	100	5297	4287	101,000
8	100	4222	2631	159100
9	100	0212	9965	24700
SS/1	100	0140	9966	17400
SS/2	100	9564	9581	-1,200
OH TIE	100	0002	0002	0
SM TA	300	0831	0831	0
TOTAL	1000	~~3612~~	3521	1,091,000

FUEL	PRESENT	PREVIOUS	USED
1-2-3	986681	986080	601
4-5	316370	316020	350
		TOTAL →	951

MAX	KW	TIME	DATE
POST	2256	1200	~~1200~~ 6/23
GVEA	2200	1400	6/28

PEAK KW DEMAND IN .99 X2400 = 2376

ENGINE OIL USED

1	2	3	4	5	TOTAL
1	1	Ø	1	Ø	3 GAL

ENGINE DAYS RUN

2	5	4	1	2	14 DAYS

HEATING DEGREE DAYS 24

OPERATOR: GIBSON

... errors. REVIEWED Signature of Supervisor ...

ELECTRIC
OPERATING LOG
MAY 95

DAY______ MONTH______ 19____

POSITION	OPERATORS 12-8 SHIFT	8-4 SHIFT	4-12 SHIFT
ENGines	PResent	CH Hours	Hr. Since OH
1	72801	71652	1149
2	83677	77849	5828
3	86040	77002	9038
4	55719.5	49188	6532
5	50647.2	46787	3860

DATE | TIME (Hour) | ENTRIES

ENGINE	KW METERS				FEEDERS				
Mult	PRESENT	PREVIOUS	DIFF	Total	*	Mult	Pres.	PREV	Total
1 X100	05634	05634	0	0	1	100	66968	66358	61,000
2 X100	92022	91984	38	3800	2	100	67444	66532	91,200
3 X100	18003	17937	66	6600	3	100	75540	75185	35,500
4 X114.3	43076	43021	55	6286.5	4	100	1185	1181	400
5 X114.3	13506	13478	28	3200.4	5	100	61387	61191	19,600
ENGine	PRESent	Previous	RUN	Standby	7	100	4287	3089	119,800
1	72801	72801	0	744	8	100	2631	0827	180,400
2	83677	83673	4	740	9	100	9965	9669	29,600
Hours 3	86040	86033	7	737	SS1	100	9966	9787	17,900
4	55719.5	55710.3	9.2	734.8	SS2	100	9581	9697	11,600
5	50647.2	50641.6	5.6	738.4	OH Lim	100	0002	0002	0
meters	PRESent	Previous	DiFF	total	Smith	300	0831	0831	0
Gvea Polex1	3632	3393	239	573600	tot	1000	3521	2293	1228000
KwHr d	8045	7533	512	1228800					
KwHr R	0	0	0	0					
Kvar d	3715	3458	257	616800					
Kvar R	0	0	0	0					
G Board in X1000	8806	7578	1228	1,228,000					
V Board out X1000	2158	2158	0	0					

Fuel	Present	Previous	Used
1,2,3	986080	985261	819
4,5	316020	315320	700
		TOTAL	1519

max KW time Date
Past 2448 At 16 MAY Hrs on 1200
GVEA 2400 At 16 MAY Hrs on 1000
Peak Kw Demand in .99 X 2400 = 2376

Engine oil used

1	2	3	4	5	total
0	3	2	3	0	8 gal

ENGINE DAYS RAN

1	2	3	4	5
0	2	2	2	1

Cyl. leaks - Quill tubes - #2 DG.

Note #3 DG Started 15 May

Operator Hamilton

NOTE—Make all entries in ink. Line out and initial all errors.

REVIEWED (Signature of Supervisor in Charge)

Htg Degree Days 457

...erations requiring small number daily entries use one sheet for...

OPERATING LOG

APRIL 95

DAY______ MONTH______ 19______

POSITION	OPERATORS 12-8 SHIFT	8-4 SHIFT	4-12 SHIFT
	72801	71652	1149
	83673	77849	5824
	86033	77002	9031
	55710	49188	6522
	50641.6	46787	3854.6

DATE[1]	TIME (Hour)	ENTRIES						
				100	66358	65722	63,600
05634	05579	55	5,500	100	66532	65646	88,600
91984	91977	7	700	100	75185	74825	36,000
17937	17937	0	0	100	1181	0523	65,800
43021	42946	75	8,5725	100	61192	60799	39,300
13478	13447	31	3,543.3	100	3089	1636	145,300
				100	0827	8993	183,400
72801	72794	7		100	9669	9342	32,700
83673	83671	2		100	9787	9582	20,500
86033	86033	0	D/L	100	9697	9609	8,800
557103	55697.3	13		100	0002	0002	0
50641.6	50637.4	4		300	0831	0831	0
				1000	2293	10,000	1,293,000
3393	3170	223	223				
7533	6992	541	1,298,400				
0	0	0	0				
3458	3200	258	619,200				
0	0	0	0				
7578	6282	1296	1,296,000		985261	984589	672
2158	2158	0	0		315320	314310	1010
						TOTAL	1682
2688	12:00		5 Apr 95				
2592	10:00		5 Apr 95				
	0.82 (1.082?)			1½ 3300 D/L	1	1	333.5
				ENGINE	Days	Run	
				1 | 2 | 3 | 4 | 5			
				3 0 0 8 1			

#2D oil change 83670 hrs.

Htg Degree Days 78

NOTE—Make all entries in ink. Line out and initial all errors.

REVIEWED (Signature of Supervisor in Charge)

[1] For operations requiring small number daily entries use one sheet for several days and insert dates in this column.

OPERATING LOG

MARCH 95

DAY________ MONTH________19______

POSITION	OPERATORS 12-8 SHIFT	8-4 SHIFT	4-12 SHIFT
	72794	71652	1142
	83671	77849	5822
	86033	77002	9031
	55697	49188	6509
	56637	46787	9850

DATE	TIME (Hour)	ENTRIES					PRES	PREV	
							65722	64921	80100
	05579	05436	143	14300			65646	64664	98200
	91977	91860	117	11700			74825	74342	48300
	17937	17937	Φ O/L	Φ O/L			0523	9656	913200
	42946	42685	261	298323			60799	60306	49300
	13447	13262	185	21145.5	/		1636	9681	804500
							8993	6751	224200
	72794	72777	17	727	/		9342	8922	42000
	83671	83655	16	728	/		9582	9308	27400
	86033	86033	O/L	O/L	/		9609	9619	1000
	55697.3	55657.7	39.6	704.4			0002	0002	Φ
	50637.4	50607.2	30.2	773.6			0831	0830	300
							10000	9343	8343000
	3170	2937	233	559200					
	6992	6321	671	1610400					
	Φ	Φ	Φ	Φ					
	3200	2920	280	672000					
	Φ	Φ	Φ	Φ	FUEL				
	6282	4672	1610	1610000		984589	982674	1915	
	2158	2158	Φ	Φ		314310	310050	4260	
								6175	
	3264	10:00	14 mar 95						
	~~3168~~	~~12:00~~	~~13 mar 95~~ 23 MAR						
	2900	1.19	2856		2	2	O/L 26	4	34 gals
		Φ	Φ						
		Φ	Φ		2	2	0	5	41
		Φ	Φ						
								1823	
								Gerhart	

NOTE—Make all entries in ink. Line out and initial all errors.

REVIEWED (Signature of Supervisor in Charge)

ELECTRIC

OPERATING LOG

FEB

DAY ______ MONTH ______ 19 95

POSITION	OPERATORS 12-8 SHIFT	8-4 SHIFT	4-12 SHIFT
ENGINES	PRESENT	O/H HOURS	HRS SINCE O/H
1	72777	71652	1125
2	83655	77849	5806
3	86033	77002	9031
4	55657.7	49188	6469
5	50607	46787	3820

DATE | TIME (Hour) | ENTRIES

ENGINE KW METERS

MULT	PRESENT	PREVIOUS	DIFF	TOTAL
1 X100	05436	05241	195	19500
2 X100	91860	91614	246	24600
3 X100	17937	17937	0	0
4 X114.3	42685	42182	503	57492.9
5 X114.3	13262	12714	548	62636.4

HRS

ENGINE	PRESENT	PREVIOUS	RUN	STANDBY
1	72777	72754	23	649
2	83655	83626	29	643
3	86033	86033	0	0 D/L
4	55657.7	55595.2	62.5	609.5
5	50607.2	50536.6	70.6	601.4

METER	PRESENT	PREVIOUS	DIFF	TOTAL
KWH x1	2937	2723	214	513600
KVAR d	6321	5731	590	1416000
KVAR r	0	0	0	0
KVAR d	2920	2676	244	585600
KVAR r	0	0	0	0
DEMAND X1000	4672	3258	1414	1414000
DEMAND X1000	2158	2158	0	0

FEEDERS

#	MULT	PRES	PREV.	TOTAL
1	100	64921	64135	78600
2	100	64664	63820	84400
3	100	74342	73891	45100
4	100	9655	8892	76300
5	100	60366	59841	46500
7	100	9681	7756	192500
8	100	6751	4626	212500
9	100	8922	8251	67100
S/1	100	9308	9079	22900
S/2	100	9619	9626	700
HE	100	0002	0002	0
SHIA	300	0830	0828	600
TOT	1000	9343	7792	1551000

FUEL	PRESENT	PREVIOUS	TOTAL
1,2,3	982674	979345	3329
4,5	310050	300380	9670

GRAND TOTAL → 12999

MAX KW @ TIME DATE

AFT 3216 1100 HRS ON 23 Feb 95

GWEA 2784 0800 HRS ON 7 Feb 95

MAX KW DEMAND IN 1.18 X 2400 = 2832

MAX KVAR DEMAND IN 0 X 2400 0

MAX KW DEMAND OUT 0 X 2400 0

MAX KVAR DEMAND OUT 0 X 2400 0

ENGINE OIL USED

1	2	3	4	5	TOTAL
3	3.5	–	6.5	23	36

ENGINE DAYS RAN

3 · 4 · 0 · 6 · 6 · 19

DEGREE DAYS: 1701

OPERATOR: Zachgo

NOTE—Make all entries in ink. Line out and initial all errors.

REVIEWED (Signature of Supervisor in Charge)

... daily entries use one sheet for ...

ELECTRIC

OPERATING LOG

JAN

DAY______ MONTH______ 19 95

ENGINES	PRESENT	-OH HOURS	HRS SINCE O/H
1	72754	71652	1102
2	83626	77849	5777
3	86033	77002	9031
4	55595.2	49188	6407.2
5	50536.6	46787	3749.6

DATE[1]	TIME (Hour)	ENTRIES

ENGINE KW METERS

MULT	PRESENT	PREVIOUS	DIFF	TOTAL
1 X 100	05241	05093	148	14800
2 X 100	91614	91530	84	8400
3 X 100	17937	17937	0	0
4 X 114.3	42182	41292	890	101727.
5 X 114.3	12714	11897	817	93383.1

HOURS

ENGINE	PRESENT	PREVIOUS	RUN	STANDBY
1	72754	72737	17	727
2	83626	83615	11	733
3	86033	86033	0	A/L
4	55595.2	55485.3	109.9	634.1
5	50536.6	50440.9	95.7	648.3

X2400

METER		PRESENT	PREVIOUS	DIFF	TOTAL
GVEA	PLEX 1	2723	2484	239	239
Kwhr	d	5731	5075	656	1,574,400
Kwhr	r	0	0	0	0
Kvar	d	2676	2405	271	650,400
Kvar	r	0	0	0	0
G	BOARDIN X100	3258	1685	1573	1,573,000
V	BOARDOUT X1000	2158	2158	0	0

FEEDERS

#	MULT	PRES	PREV.	TOTAL
1	100	64135	63234	90100
2	100	63820	62892	92800
3	100	73891	73351	54000
4	100	8892	8067	82500
5	100	59841	59328	51300
7	100	7756	5508	224800
8	100	4626	2218	240800
9	100	8521	8065	45600
SS/1	100	9079	8812	26700
SS/2	100	9626	9634	800
OH HE	100	0002	0002	0
SNIA	300	0828	0826	600
TOT	1000	7792	6028	1,764,000

FUEL	PRESENT	PREVIOUS	TOTAL
1,2,3	979345	977721	1624
4,5	300380	284950	15430

GRAND TOTAL → 17054

MAX KW @TIME DATE

POST 2408 at 1200 HRS ON 27 JAN

GVEA (100) 2900 @ 0800 HRS ON 6 JAN

PEAK KW DEMAND IN 1.12 X 2400 = 2688

PEAK KVAR DEMAND IN 0 X 2400 0

PEAK KW DEMAND OUT 0 X 2400 0

PEAK KVAR DEMAND OUT 0 X 2400 0

ENGINE OIL USED

1	2	3	4	5	TOTAL
2.5	1.5	O/L	68	11	83

ENGINE DAYS RAN

2·2·0·10·8·22

DEGREE DAYS: 1984

#2 Down for water leak #6 cyl

#3 Down for cylinder/piston repair

OPERATOR: Zachgo

NOTE—Make all entries in ink. Line out and initial all errors.

REVIEWED (Signature of Supervisor in Charge)

[1] For operations requiring small number daily entries use one sheet for several days and insert dates in this column.

ELECTRIC
OPERATING LOG

DEC

DAY ____ MONTH ____ 1994

POSITION	OPERATORS 12-8 SHIFT	8-4 SHIFT	4-12 SHIFT
ENGINES	PRESENT	O/H HOURS	HRS SINCE O/H
1	72737	71652	1,085
2	83615	77849	5,766
3	86033	77002	9,031
4	55485.3	49188	6,297.3
5	50440.9	46787	3,653.9

DATE | TIME (Hour) | ENTRIES

ENGINE KW METERS

MULT	PRESENT	PREVIOUS	DIFF	TOTAL
1 X100	05093	04648	445	44500
2 X100	91530	91120	410	41000
3 X100	17937	17937	0	0
4 X114.3	41292	40863	429	49034.7
5 X114.3	11897	11212	685	78295.5

HOURS

ENGINE	PRESENT	PREVIOUS	RUN	STANDBY
1	72737	72686	51	693
2	83615	83569	46	698
3	86033	86033	-0-	-0-
4	55485.3	55431.3	5.40	690
5	50440.9	50357.5	83.4	660.6

METER	PRESENT	PREVIOUS	DIFF	TOTAL
GVEA PLEX 1	2484	2244	240	240
Kwhr d	5075	4401	674	1617600
Kwhr r	0	0	0	0
Kvar d	2405	2126	279	669,600
Kvar r	0	0	0	0
G BOARD IN X100	1685	0068	1617	1617000
V BOARD OUT X1000	2158	2158	0	0

FEEDERS

#	MULT	PREV.	PRES.	TOTAL
1	100	63234	62354	88000
2	100	62892	61949	94300
3	100	73351	72821	53000
4	100	8067	7224	84300
5	100	59328	58812	51600
7	100	5508	3156	235200
8	100	2213	9676	253700
9	100	8065	7605	46000
SS/1	100	8812	8522	29000
SS/2	100	9634	9640	600
O/H HE	100	0002	0002	-0-
SMIA	300	0826	0824	600
TOT	1000	6028	4228	1800000

FUEL	PRESENT	PREVIOUS	TOTAL
1,2,3	977721	971040	6681
4,5	284950	274930	10020

GRAND TOTAL → 16701

MAX	KW	@TIME	DATE
POST	3456	at 1200 HRS on	Dec. 7
GVEA	2832	@ 1800 HRS on	Dec. 13

ENGINE OIL USED

1	2	3	4	5	TOTAL
50	8.5	0	4	11	73.5

PEAK KW DEMAND IN 1.19 X2400 = 2856

PEAK KVAR DEMAND IN NA X2400 0

PEAK KW DEMAND OUT 0 X2400 0

PEAK KVAR DEMAND OUT 0 X2400 0

#3 Down for Noisy Cylinder area

DEGREE DAYS: 2192

OPERATOR: J. Benson

REVIEWED (Signature of Supervisor in Charge)

NOTE—Make all entries in ink. Line out and initial all errors.

For operations requiring small number daily entries use one sheet for ...

ELECTRIC

OPERATING LOG

Nov

DAY ______ MONTH ______ 19 94

POSITION	OPERATORS 12-8 SHIFT	8-4 SHIFT	4-12 SHIFT
ENGINES			
1	72686	71652	1034
2	83569	77849	5720
3	86033	77002	9031
4	55431.3	49188.0	6243.3
5	50357.5	46787.0	3570.5

DATE[1]	TIME (Hour)	ENTRIES		

ENGINE KW METERS

MLT	PRESENT	PREVIOUS	DIFF	TOTAL
1 x 100	04648	04465	183	18300
2 x 100	91120	90747	373	37300
3 x 100	17937	17743	194	19400
4 x 114.3	40863	40737	126	14401.8
5 x 114.3	11212	11067	145	16573.5
ENGINE	PRESENT	PREVIOUS	RUN	[illegible]
1	72686	72664	22	698
2	83569	83525	44	676
3	86033	86011	22	698
4	55431.3	55416.9	14.4	705.6
5	50357.5	50337.6	19.9	700.1
METER	PRESENT	PREVIOUS	DIFF	TOTAL
[illegible] 1	2244	2017	227	227
KWH	4401	3756	645	1548000
KWH	0	0	0	0
KVAR	2126	1859	267	640800
KVAR	0	0	0	0
[illegible] x 1000	6068	8519	1549	1549000
[illegible] x 1000	2158	2158	0	0

Hours

FEEDERS

#	MULT	PRESENT	PREVIOUS	TOTAL
1	100	62354	61512	84200
2	100	61949	61022	92700
3	100	72821	72322	49900
4	100	7224	6488	73900
5	100	58812	58338	47400
7	100	3156	1288	186800
7	100	9676	7376	230000
7	100	7605	7186	41900
7/1	100	8522	8253	26900
7/2	100	9640	9649	900
[illegible]	100	0002	0002	0
[illegible]	300	0824	0822	600
TOT	1000	4228	2602	1626000

FUEL	PRESENT	PREVIOUS	USED
1,2,3	971040	965,153	5887
1,5	274930	272,670	2260
		TOTAL →	8147

MAX	KW	TIME	DATE
MLT	3360	1200 hrs	Nov 30th
MLA	2880	1800 hrs	Nov 22ND

PEAK KW DEMAND IN 1.07 X 2400 = 2568

PEAK KVAR DEMAND IN NA X 2400 = 0

PEAK KW DEMAND OUT 0 X 2400 = 0

PEAK KVAR DEMAND OUT 0 X 2400 0

ENGINE OIL USED

1	2	3	4	5	TOTAL
22.5	5	1.5	3.5	3	35.5ga

Degree Days: 1940

* EXCITER REPLACED ~~#4 D/G~~

* #3 D/L 30 Nov for Maint.

OPERATOR: T. Zoehgo

NOTE—Make all entries in ink. Line out and initial all errors.

REVIEWED (Signature of Supervisor in Charge)

[1] For operations requiring small number daily entries use one sheet for [illegible] days and insert dates in this column.

ELECTRIC
OPERATING LOG

OCT

DAY ______ MONTH ______ 19 94

POSITION	OPERATORS		
	12-8 SHIFT	8-4 SHIFT	4-12 SHIFT
ENGINES	PRESENT HRS	O/H HOURS	HRS SINCE O/H
1	72664	71652	1012
2	83525	77849	5676
3	86011	77002	9009
4	55416.9	49188.0	6228.9
5	50337.6	46787.0	3550.6

DATE TIME (Hour) ENTRIES

ENGINE KW METERS

	MULT	PRESENT	PREVIOUS	DIFF	TOTAL
1	X 100	04465	04388	77	7700
2	X 100	90747	90745	2	200
3	X 100	17743	17696	47	4900
4	X 114.3	40737	40663	74	8458.2
5	X 114.3	11067	10971	96	10972.8

HOURS

ENGINE	PRESENT	PREVIOUS	RUN	STANDBY
1	72664	72654	10	734
2	83525	83525	0	744
3	86011	86006	5	739
4	55416.9	55,407.1	9.8	734.2
5	50337.6	50,325.3	12.3	731.7

METER		PRESENT	PREVIOUS	DIFF	TOTAL
GVEA	PALX 1	2017	1784	233	~~559200~~ 233
Kwhr	d X 2400	3756	3166	590	1416000
Kwhr	r	0	0	0	0
Kvar	d	1859	1589	270	648000
Kvar	r	0	0	0	0
G	BOARD IN X 1000	8519	7109	1410	1410000
V	BOARD OUT X 1000	2158	2158	0	0

FEEDERS

#	MULT	PRESENT	PREVIOUS	TOTAL
1	100	61512	60779	73300
2	100	61022	60089	93300
3	100	72322	71905	41700
4	100	6485	5802	68300
5	100	58338	57987	35100
7	100	1288	9733	155500
8	100	7378	5299	207700
9	100	7186	6821	36500
SS/1	100	8253	8002	25100
SS/2	100	9649	9660	1100
OA/TE	100	0002	0002	0
SMIA	300	0822	0820	600
TOT	1000	2602	1182	1420000

FUEL	PRESENT	PREVIOUS	USED
1,2,3	965,153	964,167	986
4,5	272,670	271,310	1360
		TOTAL →	2346

MAX KW TIME DATE

POST 2736 at 0900 Hrs ON 27 Oct 94

GVEA 2736 at 1200 hrs on 31 Oct 94

PEAK KW DEMAND IN 1.15 X 2400 = 2760

PEAK KVAR DEMAND IN 0 X 2400 = 0

PEAK KW DEMAND OUT 0 X 2400 = 0

PEAK KVAR DEMAND OUT 0 X 2400 = 0

ENGINE OIL USED

1	2	3	4	5	TOTAL
.5	0	1	2	1	4.5

DEGREE DAYS: 1337

OPERATOR: J. Zachgo

REVIEWED (Signature of Supervisor in Charge)

NOTE - ... all ... in ink. Line out and initial all errors.

... daily entries use one sheet for ...

ELECTRIC

OPERATING LOG

Sep

DAY ______ MONTH ______ 19 94

POSITION	OPERATORS 12-8 SHIFT	8-4 SHIFT	4-12 SHIFT
ENGINES	PRESENT HRS	O/H HOURS	HRS SINCE O/H
1	72654	71652	1002
2	83525	77849	5676
3	86006	77002	9004
4	55,407.1	49188.0	6219.1
5	50,325.3	46787.0	3538.3

DATE | TIME (Hour) | ENTRIES

ENGINE KW METERS

MULT	PRESENT	PREVIOUS	DIFF	TOTAL
1 X 100	04388	04374	14	1,400
2 X 100	90745	90724	21	2.100
3 X 100	17696	17647	49	4.900
4 X 114.3	40663	40634	29	3314.7
5 X 114.3	10971	10915	56	6400.8

HOURS

ENGINE	PRESENT	PREVIOUS	RUN	STANDBY
1	72654	72653	1	719
2	83525	83522	3	717
3	86006	86000	6	714
4	55,407.1	55403.0	4.1	715.9
5	50,325.3	50317.8	7.5	712.5

METER	PRESENT	PREVIOUS	DIFF	TOTAL
GVEA Plex 1	1784	1561	223	223
Kwhr d X 2400	3166	2666	500	1,200,000
Kwhr r	0	0	0	0
Kvar d	1589	1336	253	607,200
Kvar r	0	0	0	0
G BOARDIN X 1000	7109	5910	1199	1,199,000
V BOARDOUT X1000	2158	2158	0	0

FEEDERS

#	MULT	PRESENT	PREVIOUS	TOTAL
1	100	60779	60179	60000
2	100	60089	59190	89,900
3	100	71905	71546	35,900
4	100	5802	5212	59,000
5	100	57987	57732	25,500
7	100	9733	8544	118,900
8	100	5299	3533	176,600
9	100	6821	6511	31,000
SS/1	100	8002	7821	18,100
SS/2	100	9660	9671	-1,100
GA/TE	100	0002	0002	0
SMHA	300	0820	0817	900
TOT	1000	1182	9984	1,198,000

FUEL	PRESENT	PREVIOUS	USED
1,2,3	964,167	963534	633
4,5	271,310	270630	680
		TOTAL →	1,313

MAX KW TIME DATE

POST 2448 at 1200 Hrs ON 14 SEPT

GVEA 2400 at 1200 hrs on 26 SEPT

PEAK KW DEMAND IN 1.01 X 2400 = 2424

PEAK KVAR DEMAND IN 0 X 2400 =

PEAK KW DEMAND OUT 0 X 2400 =

PEAK KVAR DEMAND OUT 0 X 2400

ENGINE OIL USED

1	2	3	4	5	TOTAL
		1	1	36	38 GAL.

DEGREE DAYS: 673

OPERATOR: B. Goodno

NOTE—Make all entries in ink. Line out and initial all errors. REVIEWED (Signature of Supervisor in Charge)

... entries use one sheet for ...

ELECTRIC OPERATING LOG

AUG. DAY ____ MONTH ____ 19 94

POSITION	OPERATORS 12-8 SHIFT	8-4 SHIFT	4-12 SHIFT
ENGINES	PRESENT HRS	O/H HOURS	HRS SINCE O/H
1	72653	71652	1001
2	83522	77849	5673
3	86000	77002	8998
4	55,403.0	49188.0	6215
5	50,317.8	46787.0	3530.8

DATE[1] TIME (Hour) ENTRIES

KW METERS

ENGINE MULT.	PRESENT	PREVIOUS	DIFF.	TOTAL
1 x100	04374	04347	27	2700
2 x100	90724	90724	0	0
3 x100	17647	17628	19	1,900
4 x114.3	40634	40593	41	4686.3
5 x114.3	10915	10874	41	4686.3

HOURS

ENGINE	PRESENT	PREVIOUS	RUN	STAND BY
1	72653	72649	4	740
2	83522	83522	0	744
3	86000	85998	2	742
4	55,403.0	55397.7	5.3	738.7
5	50,311.8	50311.5	6.3	737.7

METERS	PRESENT	PREVIOUS	DIFF.	TOTAL
WER PUL x1	1561	1326	235	235
KWHR d	2666	2192	474	1,137,600
KWHR r	0	0	0	0
VARHR d	1336	1090	246	590,400
VARHR r	0	0	0	0
G BURADIN x1000	5910	4775	1135	1,135,000
V BURADIN x1000	2158	2158	0	0

(x 2400)

FEEDERS

#	MULT	PRESENT	PREVIOUS	TOTAL
1	100	60179	59670	50,900
2	100	59190	58219	97,100
3	100	71546	71188	35,800
4	100	5212	4626	58,600
5	100	57732	57513	21,900
7	100	8544	7424	112,000
8	100	3533	1919	161,400
9	100	6511	6261	25,000
SS/1	100	7821	7650	17,100
SS/2	100	9671	9695	2,400
OR TIE	100	0002	0002	0
SMIA	300	0817	0817	0
TOT	1000	9984	8852	1,132,000

FUEL	PRESENT	PREVIOUS	USED
1,2,3	963534	963252	282
4,5	270630	270190	440
		TOTAL →	722

MAX KW TIME DATE

POST 2256 at 1200 HRS ON 29 AUG.

GUEA 2280 at 1400 HRS ON 18 AUG

ENGINE OIL USED

1	2	3	4	5	TOTAL
1			½		1½

PEAK KW DEMAND IN .95 X 2400 = 2280

PEAK KVAR DEMAND IN 0 X 2400 =

PEAK KW DEMAND OUT 0 X 2400 =

PEAK KVAR DEMAND OUT 0 X 2400 =

DEGREE DAYS 273

OPERATOR: B. Goodno

NOTE—Make all entries in ink. Line out and initial all errors.

REVIEWED (Signature of Supervisor in Charge)

[1] For operations requiring small number daily entries use one sheet for several days and insert dates in this column.

ELECTRIC OPERATING LOG

JULY

DAY______ MONTH______ 19 94

POSITION	OPERATORS 12-8 SHIFT	8-4 SHIFT	4-12 SHIFT
ENGINES	PRESENT HRS	O/H HOURS	HRS SINCE O/H
1	72649	71652	997
2	83522	77849	5673
3	85998	77002	8996
4	55397.7	49188.0	6209.7
5	50311.5	46787.0	3524.5

DATE[1] | TIME (Hour) | ENTRIES

ENGINE KW METERS

MULT.	PRESENT	PREVIOUS	DIFF.	TOTAL
1 x 100	04347	04347	0	0
2 x 100	90724	90724	0	0
3 x 100	17628	17628	0	0
4 x 114.3	40593	40548	45	5143.5
5 x 114.3	10874	10837	37	4229.1

HOURS

ENGINE	PRESENT	PREVIOUS	RUN	STAND BY
1	72649	72649	0	744
2	83522	83522	0	744
3	85998	85998	0	744
4	55397.7	55391.6	6.1	737.9
5	50311.5	50306.7	4.8	739.2

METERS		PRESENT	PREVIOUS	DIFF.	TOTAL
GUEA	POLE X1	1326	1097	229	229
KWAH	d	2192	1736	456	1,094,400
KWAH	r	0	0	0	0
KVARH	d	1090	844	246	590400
KVARH	r	0	0	0	0
G	BOARD IN X1000	4775	3684	1091	1,091,000
V	BOARD IN X1000	2158	2158	0	0

X 2400

FEEDERS

#	MULT	PRESENT	PREVIOUS	TOTAL
1	100	59670	59215	45,500
2	100	58219	57284	93,500
3	100	71188	70900	28800
4	100	4626	4037	58900
5	100	57513	57311	202,00
7	100	7424	6355	106900
8	100	1919	0346	157300
9	100	6261	6017	24,400
SS/1	100	7650	7478	17200
SS/2	100	9695	9731	-3600
OR THE	100	0002	0002	0
SMA	300	0817	0817	0
TOT	1000	8852	7768	1,066,000

FUEL	PRESENT	PREVIOUS	USED
1,2,3	963252	963250	2
4,5	270190	269500	690
		TOTAL →	692

MAX KW TIME DATE

POST 2256 at 1200 HRS ON 21 JULY 94

GUEA 2100 at 1600 HRS ON 21 JULY 94

ENGINE OIL USED

1	2	3	4	5	TOTAL
0	1/2	1	2	1 1/2	5

PEAK KW DEMAND IN 0.91 X 2400 = 2184

PEAK KVAR DEMAND IN 0 X 2400 = 0

PEAK KW DEMAND OUT 0 X 2400 = 0

PEAK KVAR DEMAND OUT 0 X 2400 = 0

DEGREE DAYS 133

OPERATOR J. GIBSON

NOTE—Make all entries in ink. Line out and initial all errors.

REVIEWED *(Signature of Supervisor in Charge)*

[1] For operations requiring small number daily entries use one sheet for several days and insert dates in this column.

APPENDIX E

Modelling Calculations

LUMPED LOAD CALCULATIONS

The following are definitions of terms and descriptions of calculations used in the the lumped load calculations on the spreadsheets contained in this section.

Estimated Demand - This value is entered by the user. It is used to calculate the "Estimated Load Each" from the "3 Ph. Eq. KVA". It represents the percent of connected KVA to which the transformer is actually loaded.

Power Factor - All transformers are assumed to operating at a 95% power factor based upon the yearly peak load data from December 7, 1994 at 12:00 hours, AST. Since the majority of the loads on the base are lighting loads and other high power factor loads this assumption is reasonable.

Voltage - The feeder voltage.

Feeder Ampacity - The feeder ampacity is taken form the "Electric Plant Operating Log" for December 7, 1994 at 1200 hours, AST. This is the peak post load for the year and is selected because it represents the worst case loading.

Bus No. - This column contains the bus numbers served by a feeder and referenced to the one-line diagrams.

Trans No. - This column contains the transformer number as it referenced on the one-line diagram.

1 Ph, KVA - This column contains the KVA rating of the single phase transformers in the bank.

Trans. Phase - This column indicates weather the transformers in the bank are connected single phase or three phase.

3 Ph. Eq. KVA - This column contains the three phase equivalent kVA for the transformer bank depending upon it's connection. This column is necessary since the DAPPER Program cannot model single phase loads. For the purpose of this study the line currents are of most importance since they are directly responsible for the magnitude of the line losses. This column contains the "1 Ph. KVA" column times $\sqrt{3}$ for single phase transformers to simulate the single phase current that the transformer would normally draw on one phase, only on all three phases. This column contains the "1 Ph. KVA" column times 3 for the three phase transformers.

Estimated Load Each/KVA - This column contains the product of the "Estimated Demand" and the "3 Ph. Eq. KVA" columns.

Estimated Load Each/KW - This column contains the product of the "Estimated Load Each/KVA" column and the "Power Factor".

Estimated Load Each/KVAR - This column contains the square-root of the "Estimated Load Each/KVA" squared minus the "Estimated Load Each/KW" squared.

Est. Lumped Load/KW - This column contains the sum of the "Estimated Load Each/KW"'s for the "Bus No." shown in the far left column. These values are entered into the DAPPER Program as special loads for the bus.

Est. Lumped Load/KVAR - This column contains the sum of the "Estimated Load Each/KVAR"'s for the "Bus No." shown in the far left column. These values are entered into the DAPPER Program as special loads for the bus.

Feeder Totals - This row contains the sum of columns:

- 1 Ph. KVA
- 3 Ph. Eq. KVA
- Estimated Load Each/KVA
- Estimated Load Each/KW
- Estimated Load Each/KVAR
- Est. Lumped Load/KW
- Est. Lumped Load/KVAR

Feeder Ampacity Total - This cell contains the calculated demand amps based on the sum of the "Estimated Load Each/KVA". It is not used for any other calculations nor is it entered into the DAPPER Program. It is simply used as reference compared to the Feeder Ampacity above.

Estimate of Poles
1995 - 1997 Study

Pole Spacing	125 ft	
Overhead Electric Lines	31.2 mi	
Total Number of Poles	1318	$= \frac{\text{Overhead Electric Lines} * 5280}{\text{Pole Spacing}}$
Percent Bad Cross-Arms	5%	
Total number of cross arms to be replaced	66	= Total Number of Poles * Percent Bad Cross-Arms
Total number of insulators	3954	= Total Number Poles * 3
Percent Bad Insulators	15%	
Total number on insulators to be replaced	594	= Total Number of Insulators * Percent Bad Insulators
No. of Grounded poles per mile	4	
Total grounded Poles:	329	$= \frac{\text{Miles} * 5280''}{\text{Pole Spacing} * \text{\# of GND. Poles/mile}}$
#4 Ground Wire per pole	50 ft	
Total length of ground conductor	16.47 mft	

LUMPED LOAD CALCULATIONS

1995 to 1997 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	35%	**Voltage**	2,400
Power Factor	95%	**Feeder Ampacity**	125

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
					Estimated Load Each			Est. Lumped Load	
	Trans. No.	1 Ph. KVA	Trans. Phase		KVA	KW	KVAR	KW	KVAR
105	1-1	15	1	25.98	8.96	8.52	2.80	9	3
110	1-2	37.5	1	64.95	22.41	21.29	7.00	21	7
115	1-3	25	3	75.00	25.88	24.58	8.08	25	8
120	1-4	50	3	150.00	51.75	49.16	16.16	222	73
	1-5	50	3	150.00	51.75	49.16	16.16		
	1-6	100	1	173.21	59.76	56.77	18.66		
	1-7	75	1	129.90	44.82	42.58	13.99		
	1-8	37.5	1	64.95	22.41	21.29	7.00		
121	1-9	10	1	17.32	5.98	5.68	1.87	62	21
	1-10	25	1	43.30	14.94	14.19	4.66		
	1-11	37.5	1	64.95	22.41	21.29	7.00		
	1-12	37.5	1	64.95	22.41	21.29	7.00		
122	1-13	25	1	43.30	14.94	14.19	4.66	98	32
	1-14	10	3	30.00	10.35	9.83	3.23		
	1-15	75	3	225.00	77.63	73.74	24.24		
125	1-16	25	1	43.30	14.94	14.19	4.66	62	20
	1-17	50	1	86.60	29.88	28.38	9.33		
	1-18	5	3	15.00	5.18	4.92	1.62		
	1-19	25	1	43.30	14.94	14.19	4.66		
130	1-20	50	1	86.60	29.88	28.38	9.33	31	10
	1-21	5	1	8.66	2.99	2.84	0.93		
135	1-22	25	1	43.30	14.94	14.19	4.66	14	5
Feeder Totals		**1225**		**1,649.59**	**569.11**	**540.65**	**177.70**	**544**	**179**
Feeder Ampacity					**136.91**				

LUMPED LOAD CALCULATIONS

1995 to 1997 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	41%	**Voltage**	2,400
Power Factor	95%	**Feeder Ampacity**	122

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
					Estimated Load Each			Est. Lumped Load	
	Trans. No.	1 Ph. KVA	Trans. Phase		KVA	KW	KVAR	KW	KVAR
205	2-1	15	3	45.00	18.45	17.53	5.76	69	22
	2-2	37.5	3	112.50	46.13	43.82	14.40		
210	2-3	75	3	225.00	92.25	87.64	28.81	88	29
215	2-4	75	3	225.00	92.25	87.64	28.81	88	29
220	2-5	50	3	150.00	61.50	58.43	19.20	58	19
235	2-6	37.5	3	112.50	46.13	43.82	14.40	44	14
236	2-7	75	3	225.00	92.25	87.64	28.81	88	29
240	2-8	75	3	225.00	92.25	87.64	28.81	88	29
Feeder Totals		**1320**		**1,320.00**	**541.20**	**514.14**	**168.99**	**522**	**171**
Feeder Ampacity					**130.19**				

LUMPED LOAD CALCULATIONS
1995 to 1997 Study
Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	34%	**Voltage**	2,400
Power Factor	95%	**Feeder Ampacity**	85

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
301	3-1	30	1	51.96	17.64	16.76	5.51	186	61
	3-2	50	3	150.00	50.93	48.38	15.90		
	3-3	50	3	150.00	50.93	48.38	15.90		
	3-4	75	3	225.00	76.39	72.57	23.85		
305	3-5	15	3	45.00	15.28	14.51	4.77	15	5
310	3-6	15	3	45.00	15.28	14.51	4.77	162	54
	3-7	15	3	45.00	15.28	14.51	4.77		
	3-8	50	3	150.00	50.93	48.38	15.90		
	3-9	0	0	0.00	0.00	0.00	0.00		
	3-10	37.5	3	112.50	38.19	36.28	11.93		
	3-11	37.5	3	112.50	38.19	36.28	11.93		
	3-12	15	1	25.98	8.82	8.38	2.75		
Feeder Totals		**840**		**1,112.94**	**377.84**	**358.95**	**117.98**	**363**	**120**
Feeder Ampacity					**90.90**				

LUMPED LOAD CALCULATIONS

1995 to 1997 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	26%	**Voltage**	2,400
Power Factor	95%	**Feeder Ampacity**	100

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
					Estimated Load Each			Est. Lumped Load	
	Trans. No.	1 Ph. KVA	Trans. Phase		KVA	KW	KVAR	KW	KVAR
401	4-1	100	3	300.00	78.75	74.81	24.59	75	25
403	4-2	166.67	3	500.01	131.25	124.69	40.98	125	41
405	4-3	50	3	150.00	39.38	37.41	12.29	65	22
	4-4	37.5	3	112.50	29.53	28.05	9.22		
410	4-5	25	3	75.00	19.69	18.70	6.15	143	47
	4-6	166.67	3	500.01	131.25	124.69	40.98		
Feeder Totals		**1637.52**		**1,637.52**	**429.85**	**408.36**	**134.22**	**408**	**134**
Feeder Ampacity					**103.41**				

LUMPED LOAD CALCULATIONS

1995 to 1997 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	11%	**Voltage**	2,400
Power Factor	95%	**Feeder Ampacity**	60

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
					Estimated Load Each			Est. Lumped Load	
	Trans. No.	1 Ph. KVA	Trans. Phase		KVA	KW	KVAR	KW	KVAR
510	5-1	100	3	300.00	33.00	31.35	10.30	31	10
512	5-2	15	1	25.98	2.86	2.71	0.89	14	5
	5-3	37.5	3	112.50	12.38	11.76	3.86		
514	5-5	15	3	45.00	4.95	4.70	1.55	5	2
515	5-4	25	3	75.00	8.25	7.84	2.58	8	3
520	5-6	15	3	45.00	4.95	4.70	1.55	5	2
525	5-7	15	3	45.00	4.95	4.70	1.55	8	3
	5-8	10	3	30.00	3.30	3.14	1.03		
530	5-9	10	1	17.32	1.91	1.81	0.59	5	1
	5-10	15	1	25.98	2.86	2.71	0.89		
	5-11	0	0	0.00	0.00	0.00	0.00		
531	5-12	50	3	150.00	16.50	15.68	5.15	16	5
535	5-13	25	1	43.30	4.76	4.52	1.49	5	1
540	5-14	10	1	17.32	1.91	1.81	0.59	2	1
545	5-16	37.5	3	112.50	12.38	11.76	3.86	12	4
550	5-15	10	1	17.32	1.91	1.81	0.59	2	1
565	5-17	15	3	45.00	4.95	4.70	1.55	5	2
570	5-18	25	3	75.00	8.25	7.84	2.58	8	3
575	5-19	5	3	15.00	1.65	1.57	0.52	2	1
580	5-20	25	3	75.00	8.25	7.84	2.58	8	3
585	5-21	75	3	225.00	24.75	23.51	7.73	24	8
590	5-22	37.5	3	112.50	12.38	11.76	3.86	41	17
	5-23	15	3	45.00	4.95	4.70	1.55		
	5-24	37.5	3	112.50	12.38	11.76	3.86		
595	5-25	15	3	45.00	4.95	4.70	1.55	33	10
	5-26	50	3	150.00	16.50	15.68	5.15		
	5-27	15	1	25.98	2.86	2.71	0.89		
	5-28	15	1	25.98	2.86	2.71	0.89		
Feeder Totals		**637.5**		**2,014.19**	**221.56**	**210.48**	**69.18**	**230**	**78**
Feeder Ampacity					**53.30**				

LUMPED LOAD CALCULATIONS

1995 to 1997 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	29%	**Voltage**	2,400
Power Factor	95%	**Feeder Ampacity**	112

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
705	7-1	50	3	150.00	43.50	41.33	13.58	41	14
709	7-2	100	3	300.00	87.00	82.65	27.17	83	27
710	7-3	25	3	75.00	21.75	20.66	6.79	84	28
	7-4	25	3	75.00	21.75	20.66	6.79		
	7-5	37.5	1	64.95	18.84	17.89	5.88		
	7-6	5	3	15.00	4.35	4.13	1.36		
	7-7	25	3	75.00	21.75	20.66	6.79		
715	7-8	25	3	75.00	21.75	20.66	6.79	21	7
720	7-9	37.5	3	112.50	32.63	30.99	10.19	31	10
725	7-10	15	3	45.00	13.05	12.40	4.07	93	30
	7-11	25	3	75.00	21.75	20.66	6.79		
	7-12	25	1	43.30	12.56	11.93	3.92		
	7-13	75	1	129.90	37.67	35.79	11.76		
	7-15	25	1	43.30	12.56	11.93	3.92		
730	7-16	15	3	45.00	13.05	12.40	4.07	12	4
735	7-14	25	3	75.00	21.75	20.66	6.79	21	7
740	7-17	10	3	30.00	8.70	8.27	2.72	17	5
	7-19	10	3	30.00	8.70	8.27	2.72		
750	7-18	25	3	75.00	21.75	20.66	6.79	21	7
755	7-20	15	1	25.98	7.53	7.16	2.35	7	2
760	7-21	25	1	43.30	12.56	11.93	3.92	12	4
765	7-22	25	3	75.00	21.75	20.66	6.79	21	7
770	7-23	10	1	17.32	5.02	4.77	1.57	5	2
775	7-24	10	3	30.00	8.70	8.27	2.72	12	4
Feeder Totals		**727.5**		**1,725.56**	**500.41**	**475.39**	**156.25**	**479**	**158**
Feeder Ampacity					**120.38**				

LUMPED LOAD CALCULATIONS

1995 to 1997 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	26%	**Voltage**	2,400
Power Factor	95%	**Feeder Ampacity**	100

Bus No.	Trans. No.	Connected 1 Ph. KVA	Trans. Phase	3 Ph. Eq. KVA	Computer Model Estimated Load Each KVA	KW	KVAR	Est. Lumped Load KW	KVAR
805	8-1	75	1	129.90	33.77	32.09	10.55	32	11
810	8-2	15	1	25.98	6.75	6.42	2.11	77	25
	8-3	37.5	1	64.95	16.89	16.04	5.27		
	8-4	15	1	25.98	6.75	6.42	2.11		
	8-5	37.5	1	64.95	16.89	16.04	5.27		
	8-6	75	1	129.90	33.77	32.09	10.55		
815	8-7	10	1	17.32	4.50	4.28	1.41	4	1
817	8-8	15	1	25.98	6.75	6.42	2.11	48	16
	8-9	50	1	86.60	22.52	21.39	7.03		
	8-10	37.5	1	64.95	16.89	16.04	5.27		
	8-11	5	3	15.00	3.90	3.71	1.22		
820	8-12	75	1	129.90	33.77	32.09	10.55	123	40
	8-13	37.5	1	64.95	16.89	16.04	5.27		
	8-14	75	1	129.90	33.77	32.09	10.55		
	8-15	75	1	129.90	33.77	32.09	10.55		
	8-16	25	1	43.30	11.26	10.70	3.52		
825	8-17	75	1	129.90	33.77	32.09	10.55	144	47
	8-19	75	1	129.90	33.77	32.09	10.55		
	8-18	37.5	1	64.95	16.89	16.04	5.27		
	8-20	75	1	129.90	33.77	32.09	10.55		
	8-21	37.5	1	64.95	16.89	16.04	5.27		
	8-22	37.5	1	64.95	16.89	16.04	5.27		
Feeder Totals		**265**		**1,734.06**	**450.86**	**428.31**	**140.78**	**428**	**141**
Feeder Ampacity					**108.46**				

LUMPED LOAD CALCULATIONS

1995 to 1997 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	25%	**Voltage**	7,200	
Power Factor	95%	**Feeder Ampacity**	100	(@ 2400 V)

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
					Estimated Load Each			Est. Lumped Load	
	Trans. No.	1 Ph. KVA	Trans. Phase		KVA	KW	KVAR	KW	KVAR
910	9-1	25	3	75.00	18.75	17.81	5.85	18	6
915	9-2	15	1	25.98	6.50	6.17	2.03	60	20
	9-3	37.5	3	112.50	28.13	26.72	8.78		
	9-4	37.5	3	112.50	28.13	26.72	8.78		
920	9-5	15	1	25.98	6.50	6.17	2.03	10	3
	9-6	10	1	17.32	4.33	4.11	1.35		
935	9-8	25	1	43.30	10.83	10.28	3.38	10	3
940	9-9	37.5	1	64.95	16.24	15.43	5.07	15	5
945	9-7	3	1	5.20	1.30	1.23	0.41	5	2
	9-10	10	1	17.32	4.33	4.11	1.35		
950	9-12	10	1	17.32	4.33	4.11	1.35	4	1
955	9-11	10	1	17.32	4.33	4.11	1.35	4	1
960	9-13	25	3	75.00	18.75	17.81	5.85	18	6
963	9-14	25	3	75.00	18.75	17.81	5.85	18	6
966	9-15	5	1	8.66	2.17	2.06	0.68	2	1
977	9-16	10	1	17.32	4.33	4.11	1.35	16	5
	9-17	10	1	17.32	4.33	4.11	1.35		
	9-18	10	1	17.32	4.33	4.11	1.35		
	9-19	10	1	17.32	4.33	4.11	1.35		
982	9-20	15	1	25.98	6.50	6.17	2.03	6	2
	9-21	0	0	0.00	0.00	0.00	0.00		
983	9-22	5	1	8.66	2.17	2.06	0.68	163	53
	9-23	15	1	25.98	6.50	6.17	2.03		
	9-24	50	3	150.00	37.50	35.63	11.71		
	9-25	166.67	3	500.01	125.00	118.75	39.03		
985	9-34	15	3	45.00	11.25	10.69	3.51	11	4
990	9-26	10	3	30.00	7.50	7.13	2.34	46	15
	9-27	37.5	3	112.50	28.13	26.72	8.78		
	9-28	15	1	25.98	6.50	6.17	2.03		
	9-29	15	1	25.98	6.50	6.17	2.03		
995	9-30	50	3	150.00	37.50	35.63	11.71	46	15
	9-31	15	3	45.00	11.25	10.69	3.51		
997	9-32	25	3	75.00	18.75	17.81	5.85	24	8
	9-33	15	1	25.98	6.50	6.17	2.03		
Feeder Totals		**365**		**2,008.71**	**502.18**	**477.07**	**156.80**	**477**	**157**
Feeder Ampacity					**40.27**	**(@ 7200 V)**			

Estimate of Poles
Post 2001 Study

Pole Spacing	125 ft	
Overhead Electric Lines	23.1 mi	
Total Number of Poles	976	$= \dfrac{\text{Overhead Electric Lines} * 5280}{\text{Pole Spacing}}$
Percent Bad Cross-Arms	5%	
Total number of cross arms to be replaced	49	=Total Number of Poles * Percent Bad Cross-Arms
Total number of insulators	2928	= Total Number Poles * 3
Percent Bad Insulators	15%	
Total number on insulators to be replaced	440	= Total Number of Insulators * Percent Bad Insulators
No. of Grounded poles per mile	4	
Total grounded Poles:	244	$= \dfrac{\text{Miles} * 5280''}{\text{Pole Spacing} * \text{\# of GND. Poles/mile}}$
#4 Ground Wire per pole	50 ft	
Total length of ground conductor	12.20 mft	

LUMPED LOAD CALCULATIONS

Post 2001 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	35%	**Voltage**	2,400
Power Factor	95%	**Feeder Ampacity**	125

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
105	1-1	15	1	25.98	0.00	0.00	0.00	0	0
110	1-2	37.5	1	64.95	0.00	0.00	0.00	0	0
115	1-3	25	3	75.00	0.00	0.00	0.00	0	0
120	1-4	50	3	150.00	0.00	0.00	0.00	43	14
	1-5	50	3	150.00	0.00	0.00	0.00		
	1-6	100	1	173.21	0.00	0.00	0.00		
	1-7	75	1	129.90	44.82	42.58	13.99		
	1-8	37.5	1	64.95	0.00	0.00	0.00		
121	1-9	10	1	17.32	0.00	0.00	0.00	43	14
	1-10	25	1	43.30	0.00	0.00	0.00		
	1-11	37.5	1	64.95	22.41	21.29	7.00		
	1-12	37.5	1	64.95	22.41	21.29	7.00		
122	1-13	25	1	43.30	0.00	0.00	0.00	74	24
	1-14	10	3	30.00	0.00	0.00	0.00		
	1-15	75	3	225.00	77.63	73.74	24.24		
125	1-16	25	1	43.30	0.00	0.00	0.00	0	0
	1-17	50	1	86.60	0.00	0.00	0.00		
	1-18	5	3	15.00	0.00	0.00	0.00		
	1-19	25	1	43.30	0.00	0.00	0.00		
130	1-20	50	1	86.60	0.00	0.00	0.00	0	0
	1-21	5	1	8.66	0.00	0.00	0.00		
135	1-22	25	1	43.30	0.00	0.00	0.00	0	0
Feeder Totals		**1225**		**1,649.59**	**167.26**	**158.90**	**52.23**	**159**	**52**
Feeder Ampacity					**40.24**				

LUMPED LOAD CALCULATIONS

Post 2001 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	41%	**Voltage**	2,400
Power Factor	95%	**Feeder Ampacity**	122

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
205	2-1	15	3	45.00	0.00	0.00	0.00	0	0
	2-2	37.5	3	112.50	0.00	0.00	0.00		
210	2-3	75	3	225.00	0.00	0.00	0.00	0	0
215	2-4	75	3	225.00	0.00	0.00	0.00	0	0
220	2-5	50	3	150.00	0.00	0.00	0.00	0	0
235	2-6	37.5	3	112.50	46.13	43.82	14.40	44	14
236	2-7	75	3	225.00	92.25	87.64	28.81	88	29
240	2-8	75	3	225.00	92.25	87.64	28.81	88	29
Feeder Totals		**1320**		**1,320.00**	**230.63**	**219.09**	**72.01**	**219**	**72**
Feeder Ampacity					**55.48**				

LUMPED LOAD CALCULATIONS

Post 2001 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	0%	**Voltage**	2,400
Power Factor	95%	**Feeder Ampacity**	85

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
					Estimated Load Each			Est. Lumped Load	
	Trans. No.	1 Ph. KVA	Trans. Phase		KVA	KW	KVAR	KW	KVAR
301	3-1	30	1	51.96	0.00	0.00	0.00	0	0
	3-2	50	3	150.00	0.00	0.00	0.00		
	3-3	50	3	150.00	0.00	0.00	0.00		
	3-4	75	3	225.00	0.00	0.00	0.00		
305	3-5	15	3	45.00	0.00	0.00	0.00	0	0
310	3-6	15	3	45.00	0.00	0.00	0.00	0	0
	3-7	15	3	45.00	0.00	0.00	0.00		
	3-8	50	3	150.00	0.00	0.00	0.00		
	3-9	0	0	0.00	0.00	0.00	0.00		
	3-10	37.5	3	112.50	0.00	0.00	0.00		
	3-11	37.5	3	112.50	0.00	0.00	0.00		
	3-12	15	1	25.98	0.00	0.00	0.00		
Feeder Totals		**840**		**1,112.94**	**0.00**	**0.00**	**0.00**	**0**	**0**
Feeder Ampacity					**0.00**				

LUMPED LOAD CALCULATIONS

Post 2001 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	0%	**Voltage**	2,400
Power Factor	95%	**Feeder Ampacity**	100

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
401	4-1	100	3	300.00	0.00	0.00	0.00	0	0
403	4-2	166.67	3	500.01	0.00	0.00	0.00	0	0
405	4-3	50	3	150.00	0.00	0.00	0.00	0	0
	4-4	37.5	3	112.50	0.00	0.00	0.00		
410	4-5	25	3	75.00	0.00	0.00	0.00	0	0
	4-6	166.67	3	500.01	0.00	0.00	0.00		
Feeder Totals		**1637.52**		**1,637.52**	**0.00**	**0.00**	**0.00**	**0**	**0**
Feeder Ampacity					**0.00**				

LUMPED LOAD CALCULATIONS

Post 2001 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	11%	**Voltage**	2,400
Power Factor	95%	**Feeder Ampacity**	60

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
					Estimated Load Each			Est. Lumped Load	
	Trans. No.	1 Ph. KVA	Trans. Phase		KVA	KW	KVAR	KW	KVAR
510	5-1	100	3	300.00	0.00	0.00	0.00	0	0
512	5-2	15	1	25.98	0.00	0.00	0.00	0	0
	5-3	37.5	3	112.50	0.00	0.00	0.00		
514	5-5	15	3	45.00	0.00	0.00	0.00	0	0
515	5-4	25	3	75.00	0.00	0.00	0.00	0	0
520	5-6	15	3	45.00	0.00	0.00	0.00	0	0
525	5-7	15	3	45.00	0.00	0.00	0.00	0	0
	5-8	10	3	30.00	0.00	0.00	0.00		
530	5-9	10	1	17.32	0.00	0.00	0.00	0	0
	5-10	15	1	25.98	0.00	0.00	0.00		
	5-11	0	0	0.00	0.00	0.00	0.00		
531	5-12	50	3	150.00	0.00	0.00	0.00	0	0
535	5-13	25	1	43.30	0.00	0.00	0.00	0	0
540	5-14	10	1	17.32	0.00	0.00	0.00	0	0
545	5-16	37.5	3	112.50	0.00	0.00	0.00	0	0
550	5-15	10	1	17.32	0.00	0.00	0.00	0	0
565	5-17	15	3	45.00	0.00	0.00	0.00	0	0
570	5-18	25	3	75.00	0.00	0.00	0.00	0	0
575	5-19	5	3	15.00	0.00	0.00	0.00	0	0
580	5-20	25	3	75.00	8.25	7.84	2.58	8	3
585	5-21	75	3	225.00	0.00	0.00	0.00	0	0
590	5-22	37.5	3	112.50	0.00	0.00	0.00	0	0
	5-23	15	3	45.00	0.00	0.00	0.00		
	5-24	37.5	3	112.50	0.00	0.00	0.00		
595	5-25	15	3	45.00	0.00	0.00	0.00	0	0
	5-26	50	3	150.00	0.00	0.00	0.00		
	5-27	15	1	25.98	0.00	0.00	0.00		
	5-28	15	1	25.98	0.00	0.00	0.00		
Feeder Totals		637.5		2,014.19	8.25	7.84	2.58	8	3
Feeder Ampacity					1.98				

LUMPED LOAD CALCULATIONS

Post 2001 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	29%	**Voltage**	2,400
Power Factor	95%	**Feeder Ampacity**	112

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
					Estimated Load Each			Est. Lumped Load	
	Trans. No.	1 Ph. KVA	Trans. Phase		KVA	KW	KVAR	KW	KVAR
705	7-1	50	3	150.00	43.50	41.33	13.58	41	14
709	7-2	100	3	300.00	87.00	82.65	27.17	83	27
710	7-3	25	3	75.00	0.00	0.00	0.00	21	7
	7-4	25	3	75.00	0.00	0.00	0.00		
	7-5	37.5	1	64.95	0.00	0.00	0.00		
	7-6	5	3	15.00	0.00	0.00	0.00		
	7-7	25	3	75.00	21.75	20.66	6.79		
715	7-8	25	3	75.00	21.75	20.66	6.79	21	7
720	7-9	37.5	3	112.50	0.00	0.00	0.00	0	0
725	7-10	15	3	45.00	0.00	0.00	0.00	0	0
	7-11	25	3	75.00	0.00	0.00	0.00		
	7-12	25	1	43.30	0.00	0.00	0.00		
	7-13	75	1	129.90	0.00	0.00	0.00		
	7-15	25	1	43.30	0.00	0.00	0.00		
730	7-16	15	3	45.00	0.00	0.00	0.00	0	0
735	7-14	25	3	75.00	0.00	0.00	0.00	0	0
740	7-17	10	3	30.00	0.00	0.00	0.00	8	3
	7-19	10	3	30.00	8.70	8.27	2.72		
750	7-18	25	3	75.00	21.75	20.66	6.79	21	7
755	7-20	15	1	25.98	0.00	0.00	0.00	0	0
760	7-21	25	1	43.30	0.00	0.00	0.00	0	0
765	7-22	25	3	75.00	0.00	0.00	0.00	0	0
770	7-23	10	1	17.32	0.00	0.00	0.00	0	0
775	7-24	10	3	30.00	0.00	0.00	0.00	0	0
Feeder Totals		**727.5**		**1,725.56**	**204.45**	**194.23**	**63.84**	**194**	**64**
Feeder Ampacity					**49.18**				

LUMPED LOAD CALCULATIONS

Post 2001 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	0%	**Voltage**	2,400
Power Factor	95%	**Feeder Ampacity**	100

Bus No.	**Connected**			**3 Ph. Eq. KVA**	**Computer Model**				
	Trans. No.	**1 Ph. KVA**	**Trans. Phase**		**Estimated Load Each**			**Est. Lumped Load**	
					KVA	**KW**	**KVAR**	**KW**	**KVAR**
805	8-1	75	1	129.90	0.00	0.00	0.00	0	0
810	8-2	15	1	25.98	0.00	0.00	0.00	0	0
	8-3	37.5	1	64.95	0.00	0.00	0.00		
	8-4	15	1	25.98	0.00	0.00	0.00		
	8-5	37.5	1	64.95	0.00	0.00	0.00		
	8-6	75	1	129.90	0.00	0.00	0.00		
815	8-7	10	1	17.32	0.00	0.00	0.00	0	0
817	8-8	15	1	25.98	0.00	0.00	0.00	0	0
	8-9	50	1	86.60	0.00	0.00	0.00		
	8-10	37.5	1	64.95	0.00	0.00	0.00		
	8-11	5	3	15.00	0.00	0.00	0.00		
820	8-12	75	1	129.90	0.00	0.00	0.00	0	0
	8-13	37.5	1	64.95	0.00	0.00	0.00		
	8-14	75	1	129.90	0.00	0.00	0.00		
	8-15	75	1	129.90	0.00	0.00	0.00		
	8-16	25	1	43.30	0.00	0.00	0.00		
825	8-17	75	1	129.90	0.00	0.00	0.00	0	0
	8-19	75	1	129.90	0.00	0.00	0.00		
	8-18	37.5	1	64.95	0.00	0.00	0.00		
	8-20	75	1	129.90	0.00	0.00	0.00		
	8-21	37.5	1	64.95	0.00	0.00	0.00		
	8-22	37.5	1	64.95	0.00	0.00	0.00		
Feeder Totals		**265**		**1,734.06**	**0.00**	**0.00**	**0.00**	**0**	**0**
Feeder Ampacity					**0.00**				

LUMPED LOAD CALCULATIONS

Post 2001 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	25%	**Voltage**	7,200	
Power Factor	95%	**Feeder Ampacity**	100	(@ 2400 V)

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
910	9-1	25	3	75.00	18.75	17.81	5.85	18	6
915	9-2	15	1	25.98	0.00	0.00	0.00	0	0
	9-3	37.5	3	112.50	0.00	0.00	0.00		
	9-4	37.5	3	112.50	0.00	0.00	0.00		
920	9-5	15	1	25.98	0.00	0.00	0.00	0	0
	9-6	10	1	17.32	0.00	0.00	0.00		
935	9-8	25	1	43.30	0.00	0.00	0.00	0	0
940	9-9	37.5	1	64.95	0.00	0.00	0.00	0	0
945	9-7	3	1	5.20	0.00	0.00	0.00	4	1
	9-10	10	1	17.32	4.33	4.11	1.35		
950	9-12	10	1	17.32	0.00	0.00	0.00	0	0
955	9-11	10	1	17.32	0.00	0.00	0.00	0	0
960	9-13	25	3	75.00	0.00	0.00	0.00	0	0
963	9-14	25	3	75.00	18.75	17.81	5.85	18	6
966	9-15	5	1	8.66	0.00	0.00	0.00	0	0
977	9-16	10	1	17.32	0.00	0.00	0.00	0	0
	9-17	10	1	17.32	0.00	0.00	0.00		
	9-18	10	1	17.32	0.00	0.00	0.00		
	9-19	10	1	17.32	0.00	0.00	0.00		
982	9-20	15	1	25.98	0.00	0.00	0.00	0	0
	9-21	0	0	0.00	0.00	0.00	0.00		
983	9-22	5	1	8.66	0.00	0.00	0.00	157	51
	9-23	15	1	25.98	0.00	0.00	0.00		
	9-24	50	3	150.00	37.50	37.76	12.41		
	9-25	166.67	3	500.01	125.00	118.75	39.03		
985	9-34	15	3	45.00	0.00	0.00	0.00	0	0
990	9-26	10	3	30.00	7.50	7.13	2.34	34	11
	9-27	37.5	3	112.50	28.13	26.72	8.78		
	9-28	15	1	25.98	0.00	0.00	0.00		
	9-29	15	1	25.98	0.00	0.00	0.00		
995	9-30	50	3	150.00	0.00	0.00	0.00	0	0
	9-31	15	3	45.00	0.00	0.00	0.00		
997	9-32	25	3	75.00	18.75	17.81	5.85	24	8
	9-33	15	1	25.98	6.50	6.17	2.03		
Feeder Totals		**365**		**2,008.71**	**265.20**	**254.08**	**83.51**	**254**	**84**
Feeder Ampacity					**21.27**	**(@ 7200 V)**			

APPENDIX F

Load Flow Analysis - Case 1

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

DATE: 20 NOV 95
TIME: 4 50 PM

ALL INFORMATION PRESENTED IS FOR REVIEW, APPROVAL
INTERPRETATION AND APPLICATION BY A REGISTERED
ENGINEER ONLY

DAPPER (LOAD FLOW AND VOLTAGE DROP MINI/MICRO VERSION 4.5 LEVEL 1.0)

SWING GENERATORS

BUS NO	ID	STAT	VOLTAGE	ANGLE
80	6	1	1.000	.000

PV GENERATORS

BUS NO	ID	STAT	VOLTAGE	kW	kVARMIN	kVARMAX	PARTICIPATION
10	1	1	1.000	1000.	0.	0.	1.000
20	2	1	1.000	0.	0.	0.	1.000
30	3	1	1.000	0.	0.	0.	1.000
40	4	1	1.000	0.	0.	0.	1.000
50	5	1	1.000	0.	0.	0.	1.000

NOTICE: BRANCH 920 F940 TO 925 () IS OUT OF SERVICE

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE	DUCT	INSUL
10 GEN G1	60 SWGR S	1	2400.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET				STATUS: EXISTING			
20 GEN G2	60 SWGR S	1	2400.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET				STATUS: EXISTING			
30 GEN G3	60 SWGR S	1	2400.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET				STATUS: EXISTING			
40 GEN G4	70 SWGR N	1	2400.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET				STATUS: EXISTING			
50 GEN G5	70 SWGR N	1	2400.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET				STATUS: EXISTING			
60 SWGR S	66 SM1A BLUE	1	2400.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET				STATUS: EXISTING			
60 SWGR S	70 SWGR N	1	2400.	5. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET				STATUS: EXISTING			
60 SWGR S	100 FDR 1	1	2400.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET				STATUS: EXISTING			
60 SWGR S	200 FDR 2	1	2400.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET				STATUS: EXISTING			
60 SWGR S	300 FDR 3	1	2400.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET				STATUS: EXISTING			
60 SWGR S	400 FDR 4	1	2400.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET				STATUS: EXISTING			
60 SWGR S	500 FDR 5	1	2400.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET				STATUS: EXISTING			
62 SS-1 SEC	64 MCC 4&5	1	480.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET				STATUS: EXISTING			
64 MCC 4&5	68 BLUE SSS	1	480.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET				STATUS: EXISTING			
70 SWGR N	90 SWGR O	1	2400.	10. FT	500	A	M	XLP
IMPEDANCE:	.0453 + J .0444 OHMS/M FEET				STATUS: EXISTING			

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER DESCRIPTION SIZE	TYPE	DUCT	INSUL
85 T1 SEC	90 SWGR O	1	2400.	10. FT	500	A	M	XLP
IMPEDANCE:	.0453 + J .0444 OHMS/M FEET				STATUS: EXISTING			
90 SWGR O	600 O/H BUS	1	2400.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET				STATUS: EXISTING			
90 SWGR O	700 FDR 7	1	2400.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET				STATUS: EXISTING			
90 SWGR O	800 FDR 8	1	2400.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET				STATUS: EXISTING			
90 SWGR O	900 FDR 9	1	2400.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET				STATUS: EXISTING			
100 FDR 1	105 F1F12 14	1	2400.	1500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
105 F1F12 14	110 F1 L14	1	2400.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
110 F1 L14	115 F1 L15	1	2400.	300. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
110 F1 L14	120 F1 L31	1	2400.	400. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
120 F1 L31	121 F1 L63	1	2400.	450. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
121 F1 L63	122 F1 L64	1	2400.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
121 F1 L63	125 F1 L67	1	2400.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
125 F1 L67	130 F1 L613	1	2400.	700. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
125 F1 L67	135 F1 L68	1	2400.	300. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
200 FDR 2	205	1	2400.	600. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	TYPE	DESCRIPTION DUCT	INSUL
205	210 2-3 PRI	1	2400.	150. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING	
205	235 F5 F29	1	2400.	400. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING	
210 2-3 PRI	215 2-4 PRI	1	2400.	50. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING	
215 2-4 PRI	220 2-5 PRI	1	2400.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING	
235 F5 F29	236 F2 F211	1	2400.	250. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING	
236 F2 F211	240 F1 F213	1	2400.	250. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING	
300 FDR 3	301 F8 F311	1	2400.	400. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING	
301 F8 F311	303 F713	1	2400.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING	
303 F713	305 F8 F311	1	2400.	400. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING	
305 F8 F311	310 F3 19	1	2400.	1200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING	
400 FDR 4	401 4-1 PRI	1	2400.	250. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING	
401 4-1 PRI	403 F1 F45	1	2400.	250. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING	
403 F1 F45	405 F4 10	1	2400.	500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING	
405 F4 10	410 F417 UF1	1	2400.	1000. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING	
500 FDR 5	505 F4 F5 F6UF	1	2400.	625. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING	

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

F E E D E R   D A T A

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	TYPE	DESCRIPTION DUCT	INSUL
505 F4 F5 F6UF	510 5-1 PRI	1	2400.	250. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
505 F4 F5 F6UF	512 5-3 PRI	1	2400.	1600. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
512 5-3 PRI	514 5-5 PRI	1	2400.	700. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
512 5-3 PRI	515 F5 L24	1	2400.	1200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
515 F5 L24	520 5-6 PRI	1	2400.	600. FT	6	A	B	OH-2
IMPEDANCE:	.6900 + J .1440 OHMS/M FEET					STATUS: EXISTING		
515 F5 L24	525 F5 L31	1	2400.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
525 F5 L31	530 F5 L39	1	2400.	1500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
525 F5 L31	531 F3 L41	1	2400.	500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
525 F5 L31	535 F537 L5	1	2400.	1400. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
531 F3 L41	535 F537 L5	1	2400.	900. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
535 F537 L5	540 F5 L5 UF1	1	2400.	150. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
535 F537 L5	555	1	2400.	800. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET					STATUS: EXISTING		
540 F5 L5 UF1	545 F5 L56 UF1	1	2400.	2100. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
540 F5 L5 UF1	550 F5 L55	1	2400.	1000. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
555	560 RICH SUB	1	2400.	3200. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET					STATUS: EXISTING		

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	TYPE	DESCRIPTION DUCT	INSUL
555	565 5-17 PRI	1	2400.	800. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET				STATUS: EXISTING			
562 RS SEC	930 RICH SUB	1	7200.	5. FT	4	A	B	OH-2
IMPEDANCE:	.4360 + J .1380 OHMS/M FEET				STATUS: EXISTING			
565 5-17 PRI	570 5-18 PRI	1	2400.	400. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET				STATUS: EXISTING			
565 5-17 PRI	575 F5 51	1	2400.	300. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET				STATUS: EXISTING			
575 F5 51	580 F5 L85	1	2400.	600. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET				STATUS: EXISTING			
580 F5 L85	585 F5 L87 UF1	1	2400.	350. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET				STATUS: EXISTING			
580 F5 L85	590 F5 L8911	1	2400.	250. FT	4	A	B	OH-2
IMPEDANCE:	.4360 + J .1380 OHMS/M FEET				STATUS: EXISTING			
590 F5 L8911	595 F5 L8 25	1	2400.	1150. FT	4	A	B	OH-2
IMPEDANCE:	.4360 + J .1380 OHMS/M FEET				STATUS: EXISTING			
700 FDR 7	705 WELL9 POL	1	2400.	50. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
705 WELL9 POL	709 F9 F73	1	2400.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
709 F9 F73	710 F7 L11	1	2400.	1000. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
710 F7 L11	715 F7 L13	1	2400.	500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
710 F7 L11	720 F713	1	2400.	500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
720 F713	725 7-15 PRI	1	2400.	1200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
725 7-15 PRI	730 F7 L43	1	2400.	600. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

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==========================================================================
FEEDER FROM      FEEDER TO        QTY  VOLTS   LENGTH      FEEDER  DESCRIPTION
 NO NAME          NO NAME         /PH   L-L              SIZE TYPE  DUCT  INSUL
==========================================================================

 725 7-15 PRI     735 F7 L54       1    2400.   350. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET               STATUS: EXISTING

 735 F7 L54       740 7-17 PRI     1    2400.   700. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET               STATUS: EXISTING

 735 F7 L54       745              1    2400.   625. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET               STATUS: EXISTING

 745              750 F7 L72       1    2400.   525. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET               STATUS: EXISTING

 745              760 7-21 PRI     1    2400.  1400. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET               STATUS: EXISTING

 750 F7 L72       755 F7-33        1    2400.   800. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET               STATUS: EXISTING

 760 7-21 PRI     765 7-22 PRI     1    2400.   600. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET               STATUS: EXISTING

 765 7-22 PRI     770 7-23 PRI     1    2400.   700. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET               STATUS: EXISTING

 770 7-23 PRI     775 7-24 PRI     1    2400.   700. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET               STATUS: EXISTING

 800 FDR 8        805 F8 L11       1    2400.  1800. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET               STATUS: EXISTING

 805 F8 L11       810 F8 L23       1    2400.  1000. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET               STATUS: EXISTING

 810 F8 L23       815 F8 L25       1    2400.   700. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET               STATUS: EXISTING

 810 F8 L23       817 F8 22        1    2400.   200. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET               STATUS: EXISTING

 817 F8 22        820 F8 30 UF1    1    2400.  1100. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET               STATUS: EXISTING

 820 F8 30 UF1    825 8-22 PRI     1    2400.  1700. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET               STATUS: EXISTING
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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                              F E E D E R   D A T A
==============================================================================
FEEDER FROM       FEEDER TO        QTY  VOLTS   LENGTH       FEEDER  DESCRIPTION
 NO NAME           NO NAME         /PH   L-L               SIZE TYPE  DUCT  INSUL
==============================================================================

 905 STEP SEC     910 F 96          1    7200.    600. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET                STATUS: EXISTING

 910 F 96         915 F910          1    7200.    800. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET                STATUS: EXISTING

 915 F910         920 F940          1    7200.   4500. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET                STATUS: EXISTING

 920 F940         945 F949 L1       1    7200.    800. FT  4/0    A     B    OH-2
     IMPEDANCE:    .0900 + J  .1200 OHMS/M FEET                STATUS: EXISTING

 925 ()           930 RICH SUB      1    7200.   1500. FT  4      A     B    OH-2
     IMPEDANCE:    .4360 + J  .1380 OHMS/M FEET                STATUS: EXISTING

 925 ()           935 9-8 PRI       1    7200.   1000. FT  6      A     B    OH-2
     IMPEDANCE:    .6900 + J  .1440 OHMS/M FEET                STATUS: EXISTING

 935 9-8 PRI      940 9-9 PRI       1    7200.   5000. FT  6      A     B    OH-2
     IMPEDANCE:    .6900 + J  .1440 OHMS/M FEET                STATUS: EXISTING

 945 F949 L1      950 9-12 PRI      1    7200.   2100. FT  6      A     B    OH-2
     IMPEDANCE:    .6900 + J  .1440 OHMS/M FEET                STATUS: EXISTING

 945 F949 L1      960 9-13 PRI      1    7200.   2200. FT  2      A     B    OH-2
     IMPEDANCE:    .2760 + J  .1320 OHMS/M FEET                STATUS: EXISTING

 950 9-12 PRI     955 9-11 PRI      1    7200.   1800. FT  6      A     B    OH-2
     IMPEDANCE:    .6900 + J  .1440 OHMS/M FEET                STATUS: EXISTING

 960 9-13 PRI     963 9-14 PRI      1    7200.   7600. FT  2      A     B    OH-2
     IMPEDANCE:    .2760 + J  .1320 OHMS/M FEET                STATUS: EXISTING

 963 9-14 PRI     966 9-15 PRI      1    7200.   2200. FT  2      A     B    OH-2
     IMPEDANCE:    .2760 + J  .1320 OHMS/M FEET                STATUS: EXISTING

 966 9-15 PRI     969 SW UP         1    7200.    600. FT  2      A     B    OH-2
     IMPEDANCE:    .2760 + J  .1320 OHMS/M FEET                STATUS: EXISTING

 969 SW UP        972 SW DOWN       1    7200.      5. FT  500    C     M    XLP
     IMPEDANCE:    .0300 + J  .0526 OHMS/M FEET                STATUS: EXISTING

 972 SW DOWN      975 9-16 PRI      1    7200.   8400. FT  2      A     B    OH-2
     IMPEDANCE:    .2760 + J  .1320 OHMS/M FEET                STATUS: EXISTING
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FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE	DUCT	INSUL
975 9-16 PRI	977 9-19 PRI	1	7200.	10000. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
975 9-16 PRI	980	1	7200.	3500. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
980	982 9-20 PRI	1	7200.	2000. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
980	983 9-25 PRI	1	7200.	6000. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
983 9-25 PRI	985 9-34 PRI	1	7200.	2000. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
985 9-34 PRI	987	1	7200.	6400. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
987	990 9-26 PRI	1	7200.	9800. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
987	992	1	7200.	27000. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
992	995 9-30 PRI	1	7200.	25000. FT	2	A	N	XLP
IMPEDANCE:	.3350 + J .0500 OHMS/M FEET					STATUS: EXISTING		
992	997 9-32 PRI	1	7200.	5000. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

T R A N S F O R M E R   D A T A

PRIMARY RECORD NO NAME	VOLTS L-L	PRI FLA	* SECONDARY RECORD NO NAME	VOLTS L-L	SEC FLA	NOMINAL KVA
60 SWGR S	2400.	72.	62 SS-1 SEC	480.	361.	300.0
IMPEDANCE:	.7816 + J 4.5331 PERCENT					
66 SM1A BLUE	2400.	120.	68 BLUE SSS	480.	601.	500.0
IMPEDANCE:	.8156 + J 4.7302 PERCENT					
80 UTILITY	24900.	58.	85 T1 SEC	2400.	601.	2500.0
IMPEDANCE:	.5546 + J 5.9341 PERCENT		TRANSFORMER FIXED TAP:			-5.0 %
90 SWGR O	2400.	72.	64 MCC 4&5	480.	361.	300.0
IMPEDANCE:	.5709 + J 3.3111 PERCENT					
210 2-3 PRI	2400.	54.	225 2-3 SEC	480.	271.	225.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
215 2-4 PRI	2400.	54.	230 2-4 SEC	208.	625.	225.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
410 F417 UF1	2400.	120.	415 4-6 SEC	208.	1388.	500.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
545 F5 L56 UF1	2400.	27.	547 5-16 SEC	208.	312.	112.5
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
560 RICH SUB	2400.	144.	562 RS SEC	7200.	48.	600.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
590 F5 L8911	2400.	12.	591 5-23 SEC	208.	139.	50.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
590 F5 L8911	2400.	27.	593 5-24 SEC	208.	312.	112.5
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
705 WELL9 POL	2400.	36.	707 7-1 SEC	480.	180.	150.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
900 FDR 9	2400.	361.	905 STEP SEC	7200.	120.	1500.0
IMPEDANCE:	.7816 + J 4.5331 PERCENT					
983 9-25 PRI	7200.	40.	984 9-25 SEC	208.	1388.	500.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					

B U S S P E C I A L S T U D Y D A T A

* NO	* NAME	* KW	* KVAR	* LOAD TYPE
105	F1F12 14	9.	3.	CONSTANT Z LOAD
110	F1 L14	21.	7.	CONSTANT Z LOAD
115	F1 L15	25.	8.	CONSTANT Z LOAD
120	F1 L31	222.	73.	CONSTANT Z LOAD
121	F1 L63	62.	21.	CONSTANT Z LOAD
122	F1 L64	98.	32.	CONSTANT Z LOAD
125	F1 L67	62.	20.	CONSTANT Z LOAD
130	F1 L613	31.	10.	CONSTANT Z LOAD
135	F1 L68	14.	5.	CONSTANT Z LOAD
205		69.	22.	CONSTANT Z LOAD
210	2-3 PRI	88.	29.	CONSTANT Z LOAD
215	2-4 PRI	88.	29.	CONSTANT Z LOAD
220	2-5 PRI	58.	19.	CONSTANT Z LOAD
235	F5 F29	44.	14.	CONSTANT Z LOAD
236	F2 F211	88.	29.	CONSTANT Z LOAD
240	F1 F213	88.	29.	CONSTANT Z LOAD
301	F8 F311	186.	61.	CONSTANT Z LOAD
305	F8 F311	15.	5.	CONSTANT Z LOAD
310	F3 19	162.	54.	CONSTANT Z LOAD
401	4-1 PRI	75.	25.	CONSTANT Z LOAD
403	F1 F45	125.	41.	CONSTANT KVA LOAD
405	F4 10	65.	22.	CONSTANT Z LOAD
410	F417 UF1	143.	47.	CONSTANT Z LOAD
510	5-1 PRI	31.	10.	CONSTANT Z LOAD
512	5-3 PRI	14.	5.	CONSTANT Z LOAD
514	5-5 PRI	5.	2.	CONSTANT Z LOAD
515	F5 L24	8.	3.	CONSTANT Z LOAD
520	5-6 PRI	5.	2.	CONSTANT Z LOAD
525	F5 L31	8.	3.	CONSTANT Z LOAD
530	F5 L39	5.	2.	CONSTANT Z LOAD
531	F3 L41	16.	5.	CONSTANT Z LOAD
535	F537 L5	5.	2.	CONSTANT Z LOAD
540	F5 L5 UF1	2.	1.	CONSTANT Z LOAD
545	F5 L56 UF1	12.	4.	CONSTANT Z LOAD
550	F5 L55	2.	1.	CONSTANT Z LOAD
565	5-17 PRI	5.	2.	CONSTANT Z LOAD
570	5-18 PRI	8.	3.	CONSTANT Z LOAD
575	F5 51	2.	1.	CONSTANT Z LOAD

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BUS SPECIAL STUDY DATA

* NO *	NAME *	KW *	KVAR *	LOAD TYPE
580	F5 L85	8.	3.	CONSTANT Z LOAD
585	F5 L87 UF1	24.	8.	CONSTANT Z LOAD
590	F5 L8911	41.	11.	CONSTANT Z LOAD
595	F5 L8 25	33.	10.	CONSTANT Z LOAD
705	WELL9 POL	41.	14.	CONSTANT Z LOAD
709	F9 F73	83.	27.	CONSTANT Z LOAD
710	F7 L11	84.	28.	CONSTANT Z LOAD
715	F7 L13	21.	7.	CONSTANT Z LOAD
720	F713	31.	10.	CONSTANT Z LOAD
725	7-15 PRI	92.	30.	CONSTANT Z LOAD
730	F7 L43	12.	4.	CONSTANT Z LOAD
735	F7 L54	21.	7.	CONSTANT Z LOAD
740	7-17 PRI	17.	5.	CONSTANT Z LOAD
750	F7 L72	21.	7.	CONSTANT Z LOAD
755	F7-33	7.	2.	CONSTANT Z LOAD
760	7-21 PRI	12.	4.	CONSTANT Z LOAD
765	7-22 PRI	21.	7.	CONSTANT Z LOAD
770	7-23 PRI	5.	2.	CONSTANT Z LOAD
775	7-24 PRI	12.	4.	CONSTANT Z LOAD
805	F8 L11	30.	10.	CONSTANT Z LOAD
810	F8 L23	73.	24.	CONSTANT Z LOAD
815	F8 L25	4.	1.	CONSTANT Z LOAD
817	F8 22	44.	15.	CONSTANT Z LOAD
820	F8 30 UF1	116.	38.	CONSTANT Z LOAD
825	8-22 PRI	136.	45.	CONSTANT KVA LOAD
910	F 96	18.	6.	CONSTANT Z LOAD
915	F910	60.	20.	CONSTANT Z LOAD
920	F940	10.	3.	CONSTANT Z LOAD
935	9-8 PRI	10.	3.	CONSTANT Z LOAD
940	9-9 PRI	15.	5.	CONSTANT Z LOAD
945	F949 L1	5.	2.	CONSTANT Z LOAD
950	9-12 PRI	4.	1.	CONSTANT Z LOAD
955	9-11 PRI	4.	1.	CONSTANT Z LOAD
960	9-13 PRI	18.	6.	CONSTANT Z LOAD
963	9-14 PRI	18.	6.	CONSTANT Z LOAD
966	9-15 PRI	2.	1.	CONSTANT Z LOAD
977	9-19 PRI	16.	5.	CONSTANT Z LOAD
982	9-20 PRI	6.	2.	CONSTANT Z LOAD

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

B U S   S P E C I A L   S T U D Y   D A T A

NO	NAME	KW	KVAR	LOAD TYPE
983	9-25 PRI	163.	53.	CONSTANT Z LOAD
985	9-34 PRI	11.	4.	CONSTANT Z LOAD
990	9-26 PRI	46.	15.	CONSTANT Z LOAD
995	9-30 PRI	46.	15.	CONSTANT Z LOAD
997	9-32 PRI	21.	7.	CONSTANT Z LOAD

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

*** SOLUTION COMMENTS ***

SOLUTION PARAMETERS

BRANCH VOLTAGE CRITERIA	:	4.00 %
BUS VOLTAGE CRITERIA	:	5.00 %
ACCELERATION FACTOR FOR 'PV' GENERATORS	:	1.00
ACCELERATION FACTOR FOR CONSTANT KVA LOADS	:	1.00
EXACT(ITERATIVE) SOLUTION	:	YES

<<PERCENT VOLTAGE DROPS ARE BASED ON NOMINAL DESIGN VOLTAGES>>

TOF SIZE: 463

LARGEST LOAD:	1000.00 KVA		
CONVERGENCE CRITERIA:	.050 KVA		
LARGEST BUS MISMATCH	10	GEN G1	36.344 KVA
LARGEST BUS MISMATCH	10	GEN G1	.878 KVA
LARGEST BUS MISMATCH	10	GEN G1	.013 KVA

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (SWING GENERATORS)
****

BUS	VOLTS(PU)	ANGLE	KW	KVAR	VD%	R + JX (PU)
80	1.000	.00	2480.4	1361.5	.0	

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (PV GENERATOR SCHEDULE REPORT)
****

		---VOLTAGE---		-KVAR LIMITS-		---ACTUAL----	
BUS NAME	ID	SCHED.	ACTUAL	MIN	MAX	KW	KVAR
10 GEN G1	1	1.000	1.018	.0	.0	1000.0	.0
20 GEN G2	2	1.000	1.018	.0	.0	.0	.0
30 GEN G3	3	1.000	1.018	.0	.0	.0	.0
40 GEN G4	4	1.000	1.018	.0	.0	.0	.0
50 GEN G5	5	1.000	1.018	.0	.0	.0	.0

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:    10 GEN G1      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2443 %VD: -1.8
======================== PU BUS VOLTAGE:  1.018         ANGLE:  -3.0 DEGREES
              ** PV TYPE GENERATOR:    1     1000.0 KW        .0 KVAR

LOAD   TO:   60 SWGR S        FEEDER AMPS:   236 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:    1000.0 KW        .0 KVAR    1000.0 KVA  PF:1.00 UNITY
LOSSES THRU FEEDER:          .3 KW        .4 KVAR        .5 KVA


==== BUS:    20 GEN G2      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2442 %VD: -1.8
======================== PU BUS VOLTAGE:  1.018         ANGLE:  -3.0 DEGREES
              ** PV TYPE GENERATOR:    2         .0 KW        .0 KVAR
**** NO LOAD SPECIFIED ****


==== BUS:    30 GEN G3      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2442 %VD: -1.8
======================== PU BUS VOLTAGE:  1.018         ANGLE:  -3.0 DEGREES
              ** PV TYPE GENERATOR:    3         .0 KW        .0 KVAR
**** NO LOAD SPECIFIED ****


==== BUS:    40 GEN G4      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2442 %VD: -1.8
======================== PU BUS VOLTAGE:  1.018         ANGLE:  -3.0 DEGREES
              ** PV TYPE GENERATOR:    4         .0 KW        .0 KVAR
**** NO LOAD SPECIFIED ****


==== BUS:    50 GEN G5      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2442 %VD: -1.8
======================== PU BUS VOLTAGE:  1.018         ANGLE:  -3.0 DEGREES
              ** PV TYPE GENERATOR:    5         .0 KW        .0 KVAR
**** NO LOAD SPECIFIED ****


==== BUS:    60 SWGR S      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2442 %VD: -1.8
======================== PU BUS VOLTAGE:  1.018         ANGLE:  -3.0 DEGREES

LOAD FROM:    10 GEN G1       FEEDER AMPS:   236 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     999.7 KW       -.4 KVAR     999.7 KVA  PF:1.00 UNITY
LOSSES THRU FEEDER:          .3 KW        .4 KVAR        .5 KVA

LOAD FROM:    20 GEN G2       FEEDER AMPS:       VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:        .0 KW        .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA
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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

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******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD FROM:   30 GEN G3       FEEDER AMPS:        VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:        .0 KW        .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD FROM:   62 SS-1 SEC     TRANSF AMPS:        VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:        .2 KW        .4 KVAR        .5 KVA  PF: .45 LAGGING
LOSSES THRU TRANSF:      .0 KW       .0 KVAR       .0 KVA

LOAD FROM:   66 SM1A BLUE    FEEDER AMPS:        VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:        .3 KW        .7 KVAR        .7 KVA  PF: .47 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD FROM:   70 SWGR N       FEEDER AMPS:    317 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:    1130.1 KW    724.2 KVAR    1342.2 KVA  PF: .84 LAGGING
LOSSES THRU FEEDER:          .0 KW        .1 KVAR        .1 KVA

LOAD   TO:  100 FDR 1        FEEDER AMPS:    136 VOLTAGE DROP:   1. %VD:   .1
PROJECTED POWER FLOW:     545.0 KW    189.7 KVAR     577.1 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .3 KW        .1 KVAR        .3 KVA

LOAD   TO:  200 FDR 2        FEEDER AMPS:    133 VOLTAGE DROP:   1. %VD:   .1
PROJECTED POWER FLOW:     535.5 KW    178.7 KVAR     564.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW        .1 KVAR        .3 KVA

LOAD   TO:  300 FDR 3        FEEDER AMPS:     93 VOLTAGE DROP:   1. %VD:   .0
PROJECTED POWER FLOW:     372.8 KW    125.1 KVAR     393.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR        .1 KVA

LOAD   TO:  400 FDR 4        FEEDER AMPS:    104 VOLTAGE DROP:   1. %VD:   .0
PROJECTED POWER FLOW:     415.9 KW    139.6 KVAR     438.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .1 KVAR        .2 KVA

LOAD   TO:  500 FDR 5        FEEDER AMPS:     65 VOLTAGE DROP:   1. %VD:   .0
PROJECTED POWER FLOW:     261.2 KW     91.7 KVAR     276.8 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .1 KW        .0 KVAR        .1 KVA
```

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:    62 SS-1 SEC   DESIGN VOLTAGE:   480  BUS VOLTAGE:   488 %VD: -1.8
======================== PU BUS VOLTAGE:  1.018        ANGLE:  -3.0 DEGREES

LOAD   TO:    60 SWGR S      TRANSF AMPS:     1 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:        .2 KW       .4 KVAR        .5 KVA  PF: .45 LAGGING
LOSSES THRU TRANSF:       .0 KW      .0 KVAR      .0 KVA

LOAD FROM:    64 MCC 4&5     FEEDER AMPS:     1 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:        .2 KW       .4 KVAR        .5 KVA  PF: .45 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA


==== BUS:    64 MCC 4&5    DESIGN VOLTAGE:   480  BUS VOLTAGE:   488 %VD: -1.8
======================== PU BUS VOLTAGE:  1.018        ANGLE:  -3.0 DEGREES

LOAD   TO:    62 SS-1 SEC    FEEDER AMPS:     1 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:        .2 KW       .4 KVAR        .5 KVA  PF: .45 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:    68 BLUE SSS    FEEDER AMPS:     1 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:        .3 KW       .7 KVAR        .7 KVA  PF: .47 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD FROM:    90 SWGR O      TRANSF AMPS:     1 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:        .6 KW      1.1 KVAR       1.2 KVA  PF: .46 LAGGING
LOSSES THRU TRANSF:       .0 KW      .0 KVAR      .0 KVA


==== BUS:    66 SM1A BLUE  DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2442 %VD: -1.8
======================== PU BUS VOLTAGE:  1.018        ANGLE:  -3.0 DEGREES

LOAD   TO:    60 SWGR S      FEEDER AMPS:       VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:        .3 KW       .7 KVAR        .7 KVA  PF: .47 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD FROM:    68 BLUE SSS    TRANSF AMPS:       VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:        .3 KW       .7 KVAR        .7 KVA  PF: .47 LAGGING
LOSSES THRU TRANSF:       .0 KW      .0 KVAR      .0 KVA
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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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              BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:   68 BLUE SSS   DESIGN VOLTAGE:   480  BUS VOLTAGE:   488 %VD: -1.8
======================== PU BUS VOLTAGE:  1.018        ANGLE:  -3.0 DEGREES

LOAD FROM:   64 MCC 4&5     FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .3 KW       .7 KVAR        .7 KVA  PF: .47 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:   66 SM1A BLUE   TRANSF AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .3 KW       .7 KVAR        .7 KVA  PF: .47 LAGGING
LOSSES THRU TRANSF:      .0 KW      .0 KVAR      .0 KVA


==== BUS:   70 SWGR N     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2442 %VD: -1.8
======================== PU BUS VOLTAGE:  1.018        ANGLE:  -3.0 DEGREES

LOAD FROM:   40 GEN G4      FEEDER AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .0 KW       .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD FROM:   50 GEN G5      FEEDER AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .0 KW       .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:   60 SWGR S      FEEDER AMPS:   317 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:    1130.1 KW    724.2 KVAR    1342.3 KVA  PF: .84 LAGGING
LOSSES THRU FEEDER:          .0 KW       .1 KVAR        .1 KVA

LOAD FROM:   90 SWGR O      FEEDER AMPS:   317 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:    1130.1 KW    724.2 KVAR    1342.3 KVA  PF: .84 LAGGING
LOSSES THRU FEEDER:          .1 KW       .1 KVAR        .2 KVA


==== BUS:   80 UTILITY    DESIGN VOLTAGE: 24900  BUS VOLTAGE: 24900 %VD:   .0
======================== PU BUS VOLTAGE:  1.000        ANGLE:    .0 DEGREES
              *** SWING  GENERATOR:    6      2480.4 KW      1361.5 KVAR

LOAD   TO:   85 T1 SEC      TRANSF AMPS:    66 VOLTAGE DROP: -450. %VD: -1.8
PROJECTED POWER FLOW:   2480.4 KW   1361.5 KVAR    2829.5 KVA  PF: .88 LAGGING
LOSSES THRU TRANSF:    16.0 KW    171.5 KVAR    172.3 KVA **XFMR TAPS  -5.0%**
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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:   85 T1 SEC      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2443 %VD: -1.8
======================== PU BUS VOLTAGE:  1.018        ANGLE:  -3.0 DEGREES

LOAD FROM:   80 UTILITY       TRANSF AMPS:   647 VOLTAGE DROP:  -43. %VD: -1.8
PROJECTED POWER FLOW:   2464.4 KW    1190.0 KVAR   2736.6 KVA  PF: .90 LAGGING
LOSSES THRU TRANSF:    16.0 KW    171.5 KVAR    172.3 KVA **XFMR TAPS  -5.0%**

LOAD   TO:   90 SWGR O        FEEDER AMPS:   647 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:   2464.4 KW    1190.0 KVAR   2736.6 KVA  PF: .90 LAGGING
LOSSES THRU FEEDER:         .6 KW        .6 KVAR        .8 KVA


==== BUS:   90 SWGR O      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2443 %VD: -1.8
======================== PU BUS VOLTAGE:  1.018        ANGLE:  -3.0 DEGREES

LOAD   TO:   64 MCC 4&5       TRANSF AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .6 KW       1.1 KVAR       1.2 KVA  PF: .46 LAGGING
LOSSES THRU TRANSF:       .0 KW      .0 KVAR       .0 KVA

LOAD   TO:   70 SWGR N        FEEDER AMPS:   317 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:   1130.3 KW     724.4 KVAR   1342.5 KVA  PF: .84 LAGGING
LOSSES THRU FEEDER:         .1 KW        .1 KVAR        .2 KVA

LOAD FROM:   85 T1 SEC        FEEDER AMPS:   647 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:   2463.8 KW    1189.4 KVAR   2735.9 KVA  PF: .90 LAGGING
LOSSES THRU FEEDER:         .6 KW        .6 KVAR        .8 KVA

LOAD FROM:  600 O/H BUS       FEEDER AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .0 KW        .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  700 FDR 7         FEEDER AMPS:   122 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:    489.1 KW     165.9 KVAR    516.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .2 KW        .1 KVAR        .3 KVA

LOAD   TO:  800 FDR 8         FEEDER AMPS:   102 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:    407.6 KW     144.5 KVAR    432.5 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .2 KW        .1 KVAR        .2 KVA

LOAD   TO:  900 FDR 9         FEEDER AMPS:   109 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:    436.2 KW     153.6 KVAR    462.5 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .2 KW        .1 KVAR        .2 KVA
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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  100 FDR 1      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2441 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017        ANGLE:  -3.0 DEGREES

LOAD FROM:   60 SWGR S      FEEDER AMPS:   136 VOLTAGE DROP:    1. %VD:   .1
PROJECTED POWER FLOW:     544.7 KW     189.6 KVAR     576.8 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .3 KW        .1 KVAR        .3 KVA

LOAD   TO:  105 F1F12 14    FEEDER AMPS:   136 VOLTAGE DROP:   44. %VD:  1.8
PROJECTED POWER FLOW:     544.7 KW     189.6 KVAR     576.8 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         7.5 KW      10.1 KVAR      12.6 KVA


==== BUS:  105 F1F12 14   DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2397 %VD:   .1
======================== PU BUS VOLTAGE:   .999        ANGLE:  -3.7 DEGREES
              PROJECTED SPECIAL BUS LOAD:      9.0 KW      2.5 KVAR

LOAD FROM:  100 FDR 1       FEEDER AMPS:   136 VOLTAGE DROP:   44. %VD:  1.8
PROJECTED POWER FLOW:     537.2 KW     179.6 KVAR     566.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         7.5 KW      10.1 KVAR      12.6 KVA

LOAD   TO:  110 F1 L14      FEEDER AMPS:   134 VOLTAGE DROP:    6. %VD:   .2
PROJECTED POWER FLOW:     528.2 KW     177.1 KVAR     557.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         1.0 KW       1.3 KVAR       1.6 KVA


==== BUS:  110 F1 L14     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2391 %VD:   .4
======================== PU BUS VOLTAGE:   .996        ANGLE:  -3.8 DEGREES
              PROJECTED SPECIAL BUS LOAD:     20.8 KW      6.9 KVAR

LOAD FROM:  105 F1F12 14    FEEDER AMPS:   134 VOLTAGE DROP:    6. %VD:   .2
PROJECTED POWER FLOW:     527.2 KW     175.8 KVAR     555.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         1.0 KW       1.3 KVAR       1.6 KVA

LOAD   TO:  115 F1 L15      FEEDER AMPS:     6 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      24.8 KW       7.9 KVAR      26.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  120 F1 L31      FEEDER AMPS:   123 VOLTAGE DROP:   10. %VD:   .4
PROJECTED POWER FLOW:     481.6 KW     160.9 KVAR     507.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         1.6 KW       2.2 KVAR       2.7 KVA
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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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              BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  115 F1 L15     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2391 %VD:   .4
======================== PU BUS VOLTAGE:   .996      ANGLE:  -3.8 DEGREES
              PROJECTED SPECIAL BUS LOAD:     24.8 KW      7.9 KVAR

LOAD FROM:  110 F1 L14       FEEDER AMPS:     6 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     24.8 KW      7.9 KVAR     26.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  120 F1 L31     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2381 %VD:   .8
======================== PU BUS VOLTAGE:   .992      ANGLE:  -4.0 DEGREES
              PROJECTED SPECIAL BUS LOAD:    218.5 KW     71.8 KVAR

LOAD FROM:  110 F1 L14       FEEDER AMPS:   123 VOLTAGE DROP:   10. %VD:   .4
PROJECTED POWER FLOW:    480.0 KW    158.7 KVAR    505.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:        1.6 KW      2.2 KVAR      2.7 KVA

LOAD   TO:  121 F1 L63       FEEDER AMPS:    67 VOLTAGE DROP:    6. %VD:   .3
PROJECTED POWER FLOW:    261.5 KW     86.9 KVAR    275.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .5 KW       .7 KVAR       .9 KVA


==== BUS:  121 F1 L63     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2374 %VD:  1.1
======================== PU BUS VOLTAGE:   .989      ANGLE:  -4.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:     60.7 KW     20.6 KVAR

LOAD FROM:  120 F1 L31       FEEDER AMPS:    67 VOLTAGE DROP:    6. %VD:   .3
PROJECTED POWER FLOW:    261.0 KW     86.2 KVAR    274.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .5 KW       .7 KVAR       .9 KVA

LOAD   TO:  122 F1 L64       FEEDER AMPS:    24 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     95.6 KW     31.3 KVAR    100.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .1 KVA

LOAD   TO:  125 F1 L67       FEEDER AMPS:    27 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:    104.6 KW     34.3 KVAR    110.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .1 KVAR       .1 KVA
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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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              BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  122 F1 L64     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2373 %VD:  1.1
======================== PU BUS VOLTAGE:    .989       ANGLE:  -4.1 DEGREES
             PROJECTED SPECIAL BUS LOAD:      95.6 KW      31.3 KVAR

LOAD FROM:  121 F1 L63       FEEDER AMPS:    24 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:      95.6 KW      31.3 KVAR     100.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .1 KVA


==== BUS:  125 F1 L67     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2373 %VD:  1.1
======================== PU BUS VOLTAGE:    .989       ANGLE:  -4.1 DEGREES
             PROJECTED SPECIAL BUS LOAD:      60.6 KW      19.6 KVAR

LOAD FROM:  121 F1 L63       FEEDER AMPS:    27 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     104.6 KW      34.2 KVAR     110.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .1 KVAR        .1 KVA

LOAD   TO:  130 F1 L613      FEEDER AMPS:     8 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:      30.3 KW       9.8 KVAR      31.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  135 F1 L68       FEEDER AMPS:     4 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      13.7 KW       4.9 KVAR      14.5 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA


==== BUS:  130 F1 L613    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2372 %VD:  1.2
======================== PU BUS VOLTAGE:    .988       ANGLE:  -4.1 DEGREES
             PROJECTED SPECIAL BUS LOAD:      30.3 KW       9.8 KVAR

LOAD FROM:  125 F1 L67       FEEDER AMPS:     8 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:      30.3 KW       9.8 KVAR      31.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA


==== BUS:  135 F1 L68     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2373 %VD:  1.1
======================== PU BUS VOLTAGE:    .989       ANGLE:  -4.1 DEGREES
             PROJECTED SPECIAL BUS LOAD:      13.7 KW       4.9 KVAR

LOAD FROM:  125 F1 L67       FEEDER AMPS:     4 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      13.7 KW       4.9 KVAR      14.5 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA
```

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

```
              BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  200 FDR 2       DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2441 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017        ANGLE:  -3.0 DEGREES

LOAD FROM:   60 SWGR S       FEEDER AMPS:   133 VOLTAGE DROP:    1. %VD:   .1
PROJECTED POWER FLOW:     535.2 KW     178.6 KVAR     564.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW        .1 KVAR        .3 KVA

LOAD   TO:  205             FEEDER AMPS:   133 VOLTAGE DROP:   17. %VD:   .7
PROJECTED POWER FLOW:     535.2 KW     178.6 KVAR     564.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         2.9 KW       3.8 KVAR       4.8 KVA


==== BUS:  205             DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2424 %VD: -1.0
======================== PU BUS VOLTAGE:  1.010        ANGLE:  -3.3 DEGREES
             PROJECTED SPECIAL BUS LOAD:      70.4 KW      22.4 KVAR

LOAD FROM:  200 FDR 2        FEEDER AMPS:   133 VOLTAGE DROP:   17. %VD:   .7
PROJECTED POWER FLOW:     532.3 KW     174.7 KVAR     560.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         2.9 KW       3.8 KVAR       4.8 KVA

LOAD   TO:  210 2-3 PRI      FEEDER AMPS:    60 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     238.4 KW      78.6 KVAR     251.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .2 KVAR        .2 KVA

LOAD   TO:  235 F5 F29       FEEDER AMPS:    56 VOLTAGE DROP:    5. %VD:   .2
PROJECTED POWER FLOW:     223.6 KW      73.7 KVAR     235.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW        .5 KVAR        .6 KVA


==== BUS:  210 2-3 PRI     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2422 %VD:  -.9
======================== PU BUS VOLTAGE:  1.009        ANGLE:  -3.3 DEGREES
             PROJECTED SPECIAL BUS LOAD:      89.6 KW      29.5 KVAR

LOAD FROM:  205              FEEDER AMPS:    60 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     238.2 KW      78.4 KVAR     250.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .2 KVAR        .2 KVA

LOAD   TO:  215 2-4 PRI      FEEDER AMPS:    37 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     148.6 KW      48.9 KVAR     156.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA
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              BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD FROM:  225 2-3 SEC      TRANSF AMPS:       VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:         .0 KW       .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:       .0 KW      .0 KVAR       .0 KVA


==== BUS:  215 2-4 PRI    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2422 %VD:  -.9
======================== PU BUS VOLTAGE:  1.009        ANGLE:  -3.3 DEGREES
              PROJECTED SPECIAL BUS LOAD:      89.6 KW      29.5 KVAR

LOAD FROM:  210 2-3 PRI      FEEDER AMPS:     37 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     148.6 KW     48.9 KVAR     156.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  220 2-5 PRI      FEEDER AMPS:     15 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:      59.0 KW     19.3 KVAR      62.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .0 KW       .0 KVAR        .0 KVA

LOAD FROM:  230 2-4 SEC      TRANSF AMPS:       VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:         .0 KW       .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:       .0 KW      .0 KVAR       .0 KVA


==== BUS:  220 2-5 PRI    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2421 %VD:  -.9
======================== PU BUS VOLTAGE:  1.009        ANGLE:  -3.3 DEGREES
              PROJECTED SPECIAL BUS LOAD:      59.0 KW      19.3 KVAR

LOAD FROM:  215 2-4 PRI      FEEDER AMPS:     15 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:      59.0 KW     19.3 KVAR      62.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .0 KW       .0 KVAR        .0 KVA


==== BUS:  225 2-3 SEC    DESIGN VOLTAGE:   480  BUS VOLTAGE:   484 %VD:  -.9
======================== PU BUS VOLTAGE:  1.009        ANGLE:  -3.3 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  230 2-4 SEC    DESIGN VOLTAGE:   208  BUS VOLTAGE:   210 %VD:  -.9
======================== PU BUS VOLTAGE:  1.009        ANGLE:  -3.3 DEGREES
**** NO LOAD SPECIFIED ****
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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  235 F5 F29      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2419 %VD:  -.8
======================== PU BUS VOLTAGE:  1.008        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:      44.7 KW      14.2 KVAR

LOAD FROM:  205             FEEDER AMPS:    56 VOLTAGE DROP:    5. %VD:   .2
PROJECTED POWER FLOW:     223.2 KW     73.2 KVAR    234.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW       .5 KVAR       .6 KVA

LOAD   TO:  236 F2 F211     FEEDER AMPS:    45 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     178.5 KW     59.0 KVAR    188.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .2 KVAR       .2 KVA


==== BUS:  236 F2 F211     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2417 %VD:  -.7
======================== PU BUS VOLTAGE:  1.007        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:      89.2 KW      29.4 KVAR

LOAD FROM:  235 F5 F29      FEEDER AMPS:    45 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     178.4 KW     58.8 KVAR    187.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .2 KVAR       .2 KVA

LOAD   TO:  240 F1 F213     FEEDER AMPS:    22 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      89.2 KW     29.4 KVAR     93.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .1 KVA


==== BUS:  240 F1 F213     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2415 %VD:  -.6
======================== PU BUS VOLTAGE:  1.006        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:      89.1 KW      29.4 KVAR

LOAD FROM:  236 F2 F211     FEEDER AMPS:    22 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      89.1 KW     29.4 KVAR     93.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .1 KVA


==== BUS:  300 FDR 3       DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2441 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017        ANGLE:  -3.0 DEGREES

LOAD FROM:   60 SWGR S      FEEDER AMPS:    93 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     372.7 KW    125.0 KVAR    393.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .1 KVAR       .1 KVA
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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD    TO:  301 F8 F311      FEEDER AMPS:    93 VOLTAGE DROP:    8. %VD:    .3
PROJECTED POWER FLOW:     372.7 KW     125.0 KVAR     393.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .9 KW       1.2 KVAR       1.6 KVA


==== BUS:  301 F8 F311    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2433 %VD: -1.4
======================== PU BUS VOLTAGE:  1.014         ANGLE:  -3.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:    191.2 KW       62.7 KVAR

LOAD FROM:  300 FDR 3        FEEDER AMPS:    93 VOLTAGE DROP:    8. %VD:    .3
PROJECTED POWER FLOW:     371.7 KW     123.8 KVAR     391.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .9 KW       1.2 KVAR       1.6 KVA

LOAD    TO:  303 F713        FEEDER AMPS:    45 VOLTAGE DROP:    2. %VD:    .1
PROJECTED POWER FLOW:     180.5 KW      61.1 KVAR     190.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR        .2 KVA


==== BUS:  303 F713       DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2431 %VD: -1.3
======================== PU BUS VOLTAGE:  1.013         ANGLE:  -3.2 DEGREES

LOAD FROM:  301 F8 F311      FEEDER AMPS:    45 VOLTAGE DROP:    2. %VD:    .1
PROJECTED POWER FLOW:     180.4 KW      60.9 KVAR     190.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR        .2 KVA

LOAD    TO:  305 F8 F311     FEEDER AMPS:    45 VOLTAGE DROP:    4. %VD:    .2
PROJECTED POWER FLOW:     180.4 KW      60.9 KVAR     190.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .3 KVAR        .4 KVA


==== BUS:  305 F8 F311    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2428 %VD: -1.1
======================== PU BUS VOLTAGE:  1.011         ANGLE:  -3.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:     15.3 KW        5.1 KVAR

LOAD FROM:  303 F713         FEEDER AMPS:    45 VOLTAGE DROP:    4. %VD:    .2
PROJECTED POWER FLOW:     180.2 KW      60.6 KVAR     190.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .3 KVAR        .4 KVA

LOAD    TO:  310 F3 19       FEEDER AMPS:    41 VOLTAGE DROP:   11. %VD:    .4
PROJECTED POWER FLOW:     164.8 KW      55.5 KVAR     173.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .6 KW        .7 KVAR        .9 KVA
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                 BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  310 F3 19       DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2417 %VD:  -.7
======================== PU BUS VOLTAGE:  1.007        ANGLE:  -3.4 DEGREES
               PROJECTED SPECIAL BUS LOAD:     164.3 KW     54.8 KVAR

LOAD FROM:  305 F8 F311       FEEDER AMPS:    41 VOLTAGE DROP:   11. %VD:    .4
PROJECTED POWER FLOW:     164.3 KW      54.8 KVAR     173.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .6 KW        .7 KVAR        .9 KVA


==== BUS:  400 FDR 4       DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2441 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017        ANGLE:  -3.0 DEGREES

LOAD FROM:   60 SWGR S        FEEDER AMPS:   104 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     415.7 KW     139.5 KVAR     438.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .1 KVAR        .2 KVA

LOAD   TO:  401 4-1 PRI       FEEDER AMPS:   104 VOLTAGE DROP:    6. %VD:    .2
PROJECTED POWER FLOW:     415.7 KW     139.5 KVAR     438.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .7 KW       1.0 KVAR       1.2 KVA


==== BUS:  401 4-1 PRI     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2436 %VD: -1.5
======================== PU BUS VOLTAGE:  1.015        ANGLE:  -3.1 DEGREES
               PROJECTED SPECIAL BUS LOAD:      77.2 KW     25.7 KVAR

LOAD FROM:  400 FDR 4         FEEDER AMPS:   104 VOLTAGE DROP:    6. %VD:    .2
PROJECTED POWER FLOW:     415.0 KW     138.5 KVAR     437.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .7 KW       1.0 KVAR       1.2 KVA

LOAD   TO:  403 F1 F45        FEEDER AMPS:    84 VOLTAGE DROP:    5. %VD:    .2
PROJECTED POWER FLOW:     337.7 KW     112.8 KVAR     356.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .5 KW        .6 KVAR        .8 KVA


==== BUS:  403 F1 F45      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2431 %VD: -1.3
======================== PU BUS VOLTAGE:  1.013        ANGLE:  -3.2 DEGREES
               PROJECTED SPECIAL BUS LOAD:     125.0 KW     41.0 KVAR

LOAD FROM:  401 4-1 PRI       FEEDER AMPS:    84 VOLTAGE DROP:    5. %VD:    .2
PROJECTED POWER FLOW:     337.2 KW     112.2 KVAR     355.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .5 KW        .6 KVAR        .8 KVA
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                    BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD    TO:  405 F4 10        FEEDER AMPS:    53 VOLTAGE DROP:    6. %VD:    .2
PROJECTED POWER FLOW:     212.2 KW      71.2 KVAR     223.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .4 KW        .5 KVAR        .6 KVA


==== BUS:  405 F4 10      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2425 %VD: -1.1
======================== PU BUS VOLTAGE:  1.011        ANGLE:  -3.3 DEGREES
              PROJECTED SPECIAL BUS LOAD:      66.4 KW      22.5 KVAR

LOAD FROM:  403 F1 F45        FEEDER AMPS:    53 VOLTAGE DROP:    6. %VD:    .2
PROJECTED POWER FLOW:     211.9 KW      70.6 KVAR     223.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .4 KW        .5 KVAR        .6 KVA

LOAD    TO:  410 F417 UF1     FEEDER AMPS:    36 VOLTAGE DROP:    8. %VD:    .3
PROJECTED POWER FLOW:     145.5 KW      48.2 KVAR     153.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .4 KW        .5 KVAR        .6 KVA


==== BUS:  410 F417 UF1   DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2418 %VD:  -.7
======================== PU BUS VOLTAGE:  1.007        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:     145.1 KW      47.7 KVAR

LOAD FROM:  405 F4 10         FEEDER AMPS:    36 VOLTAGE DROP:    8. %VD:    .3
PROJECTED POWER FLOW:     145.1 KW      47.7 KVAR     152.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .4 KW        .5 KVAR        .6 KVA

LOAD    TO:  415 4-6 SEC      TRANSF AMPS:        VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:        .0 KW        .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:       .0 KW       .0 KVAR       .0 KVA


==== BUS:  415 4-6 SEC    DESIGN VOLTAGE:   208  BUS VOLTAGE:   210 %VD:  -.7
======================== PU BUS VOLTAGE:  1.007        ANGLE:  -3.4 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  500 FDR 5      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2442 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017        ANGLE:  -3.0 DEGREES

LOAD FROM:   60 SWGR S        FEEDER AMPS:    65 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     261.1 KW      91.7 KVAR     276.8 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .1 KW        .0 KVAR        .1 KVA
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD   TO: 505 F4 F5 F6UF   FEEDER AMPS:    65 VOLTAGE DROP:    9. %VD:   .4
PROJECTED POWER FLOW:     261.1 KW      91.7 KVAR     276.8 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .7 KW       1.0 KVAR       1.2 KVA


==== BUS:  505 F4 F5 F6UF DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2433 %VD: -1.4
======================== PU BUS VOLTAGE:  1.014        ANGLE:  -3.1 DEGREES

LOAD FROM: 500 FDR 5        FEEDER AMPS:    65 VOLTAGE DROP:    9. %VD:   .4
PROJECTED POWER FLOW:     260.4 KW      90.7 KVAR     275.8 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .7 KW       1.0 KVAR       1.2 KVA

LOAD   TO: 510 5-1 PRI      FEEDER AMPS:     8 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      31.8 KW      10.3 KVAR      33.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD   TO: 512 5-3 PRI      FEEDER AMPS:    58 VOLTAGE DROP:   20. %VD:   .8
PROJECTED POWER FLOW:     228.6 KW      80.5 KVAR     242.3 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         1.4 KW       1.9 KVAR       2.4 KVA


==== BUS:  510 5-1 PRI    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2432 %VD: -1.3
======================== PU BUS VOLTAGE:  1.013        ANGLE:  -3.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:      31.8 KW      10.3 KVAR

LOAD FROM: 505 F4 F5 F6UF   FEEDER AMPS:     8 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      31.8 KW      10.3 KVAR      33.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA


==== BUS:  512 5-3 PRI    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2413 %VD:  -.5
======================== PU BUS VOLTAGE:  1.005        ANGLE:  -3.5 DEGREES
              PROJECTED SPECIAL BUS LOAD:      14.2 KW       5.1 KVAR

LOAD FROM: 505 F4 F5 F6UF   FEEDER AMPS:    58 VOLTAGE DROP:   20. %VD:   .8
PROJECTED POWER FLOW:     227.1 KW      78.5 KVAR     240.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         1.4 KW       1.9 KVAR       2.4 KVA

LOAD   TO: 514 5-5 PRI      FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       5.1 KW       2.0 KVAR       5.4 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD    TO:  515 F5 L24        FEEDER AMPS:    53 VOLTAGE DROP:   14. %VD:   .6
PROJECTED POWER FLOW:     207.9 KW      71.5 KVAR     219.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .9 KW       1.2 KVAR       1.5 KVA


==== BUS:  514 5-5 PRI    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2413 %VD:  -.5
======================== PU BUS VOLTAGE:  1.005        ANGLE:  -3.5 DEGREES
              PROJECTED SPECIAL BUS LOAD:       5.1 KW      2.0 KVAR

LOAD FROM:  512 5-3 PRI        FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       5.1 KW       2.0 KVAR       5.4 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA


==== BUS:  515 F5 L24     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2399 %VD:   .0
======================== PU BUS VOLTAGE:  1.000        ANGLE:  -3.7 DEGREES
              PROJECTED SPECIAL BUS LOAD:       8.0 KW      3.3 KVAR

LOAD FROM:  512 5-3 PRI        FEEDER AMPS:    53 VOLTAGE DROP:   14. %VD:   .6
PROJECTED POWER FLOW:     207.0 KW      70.3 KVAR     218.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .9 KW       1.2 KVAR       1.5 KVA

LOAD    TO:  520 5-6 PRI       FEEDER AMPS:     1 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:       5.0 KW       2.0 KVAR       5.4 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD    TO:  525 F5 L31        FEEDER AMPS:    49 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     194.0 KW      65.0 KVAR     204.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .2 KVAR        .2 KVA


==== BUS:  520 5-6 PRI    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2398 %VD:   .1
======================== PU BUS VOLTAGE:   .999        ANGLE:  -3.7 DEGREES
              PROJECTED SPECIAL BUS LOAD:       5.0 KW      2.0 KVAR

LOAD FROM:  515 F5 L24         FEEDER AMPS:     1 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:       5.0 KW       2.0 KVAR       5.4 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA
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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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               BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  525 F5 L31     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2397 %VD:   .1
======================== PU BUS VOLTAGE:    .999        ANGLE:  -3.7 DEGREES
              PROJECTED SPECIAL BUS LOAD:       8.0 KW      3.3 KVAR

LOAD FROM:  515 F5 L24       FEEDER AMPS:    49 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     193.9 KW      64.9 KVAR     204.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .2 KVAR        .2 KVA

LOAD   TO:  530 F5 L39       FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       5.0 KW       1.9 KVAR       5.3 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  531 F3 L41       FEEDER AMPS:    24 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:      95.6 KW      31.5 KVAR     100.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR        .1 KVA

LOAD   TO:  535 F537 L5      FEEDER AMPS:    22 VOLTAGE DROP:    6. %VD:   .3
PROJECTED POWER FLOW:      85.3 KW      28.2 KVAR      89.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .2 KVAR        .3 KVA


==== BUS:  530 F5 L39     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2397 %VD:   .1
======================== PU BUS VOLTAGE:    .999        ANGLE:  -3.7 DEGREES
              PROJECTED SPECIAL BUS LOAD:       5.0 KW      1.9 KVAR

LOAD FROM:  525 F5 L31       FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       5.0 KW       1.9 KVAR       5.3 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA


==== BUS:  531 F3 L41     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2395 %VD:   .2
======================== PU BUS VOLTAGE:    .998        ANGLE:  -3.7 DEGREES
              PROJECTED SPECIAL BUS LOAD:      15.9 KW      5.0 KVAR

LOAD FROM:  525 F5 L31       FEEDER AMPS:    24 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:      95.5 KW      31.3 KVAR     100.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR        .1 KVA

LOAD   TO:  535 F537 L5      FEEDER AMPS:    20 VOLTAGE DROP:    4. %VD:   .2
PROJECTED POWER FLOW:      79.6 KW      26.4 KVAR      83.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR        .2 KVA
```

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
****

VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH = 4.00 %   BUS = 5.00

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==== BUS:  535 F537 L5      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2391 %VD:   .4
======================== PU BUS VOLTAGE:   .996        ANGLE:  -3.8 DEGREES
              PROJECTED SPECIAL BUS LOAD:      5.0 KW       1.9 KVAR

LOAD FROM:  525 F5 L31       FEEDER AMPS:    22 VOLTAGE DROP:    6. %VD:   .3
PROJECTED POWER FLOW:     85.2 KW     28.0 KVAR      89.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .2 KW       .2 KVAR        .3 KVA

LOAD FROM:  531 F3 L41       FEEDER AMPS:    20 VOLTAGE DROP:    4. %VD:   .2
PROJECTED POWER FLOW:     79.5 KW     26.2 KVAR      83.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR        .2 KVA

LOAD   TO:  540 F5 L5 UF1    FEEDER AMPS:     4 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     15.9 KW      6.0 KVAR      16.9 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  555              FEEDER AMPS:    36 VOLTAGE DROP:    9. %VD:   .4
PROJECTED POWER FLOW:    143.8 KW     46.4 KVAR     151.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .5 KW       .4 KVAR        .6 KVA

==== BUS:  540 F5 L5 UF1    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2391 %VD:   .4
======================== PU BUS VOLTAGE:   .996        ANGLE:  -3.8 DEGREES
              PROJECTED SPECIAL BUS LOAD:      2.0 KW       1.0 KVAR

LOAD FROM:  535 F537 L5      FEEDER AMPS:     4 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     15.9 KW      5.9 KVAR      16.9 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  545 F5 L56 UF1   FEEDER AMPS:     3 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:     11.9 KW      4.0 KVAR      12.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  550 F5 L55       FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      2.0 KW      1.0 KVAR       2.2 KVA  PF: .89 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA
```

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  545 F5 L56 UF1 DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2387 %VD:   .5
========================= PU BUS VOLTAGE:   .995       ANGLE:  -3.8 DEGREES
              PROJECTED SPECIAL BUS LOAD:     11.9 KW      4.0 KVAR

LOAD FROM:  540 F5 L5 UF1    FEEDER AMPS:     3 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:     11.9 KW      4.0 KVAR     12.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD FROM:  547 5-16 SEC     TRANSF AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .0 KW       .0 KVAR       .0 KVA  PF: .00 LAGGING
LOSSES THRU TRANSF:      .0 KW      .0 KVAR      .0 KVA


==== BUS:  547 5-16 SEC   DESIGN VOLTAGE:   208  BUS VOLTAGE:   207 %VD:   .5
========================= PU BUS VOLTAGE:   .995       ANGLE:  -3.8 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  550 F5 L55     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2391 %VD:   .4
========================= PU BUS VOLTAGE:   .996       ANGLE:  -3.8 DEGREES
              PROJECTED SPECIAL BUS LOAD:      2.0 KW      1.0 KVAR

LOAD FROM:  540 F5 L5 UF1    FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      2.0 KW      1.0 KVAR      2.2 KVA  PF: .89 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  555            DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2382 %VD:   .7
========================= PU BUS VOLTAGE:   .993       ANGLE:  -3.9 DEGREES

LOAD FROM:  535 F537 L5      FEEDER AMPS:    36 VOLTAGE DROP:    9. %VD:   .4
PROJECTED POWER FLOW:    143.4 KW     46.0 KVAR    150.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .5 KW       .4 KVAR       .6 KVA

LOAD   TO:  560 RICH SUB     FEEDER AMPS:     6 VOLTAGE DROP:    6. %VD:   .3
PROJECTED POWER FLOW:     25.2 KW      8.4 KVAR     26.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .0 KVAR       .1 KVA

LOAD   TO:  565 5-17 PRI     FEEDER AMPS:    30 VOLTAGE DROP:    7. %VD:   .3
PROJECTED POWER FLOW:    118.2 KW     37.7 KVAR    124.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .3 KW       .3 KVAR       .4 KVA
```

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  560 RICH SUB   DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2376 %VD:  1.0
======================== PU BUS VOLTAGE:   .990        ANGLE:  -4.0 DEGREES

LOAD FROM:  555             FEEDER AMPS:     6 VOLTAGE DROP:    6. %VD:   .3
PROJECTED POWER FLOW:     25.1 KW      8.3 KVAR      26.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .0 KVAR        .1 KVA

LOAD   TO:  562 RS SEC      TRANSF AMPS:     6 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:     25.1 KW      8.3 KVAR      26.5 KVA  PF: .95 LAGGING
LOSSES THRU TRANSF:       .0 KW     .1 KVAR     .1 KVA


==== BUS:  562 RS SEC     DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7119 %VD:  1.1
======================== PU BUS VOLTAGE:   .989        ANGLE:  -4.1 DEGREES

LOAD FROM:  560 RICH SUB    TRANSF AMPS:     2 VOLTAGE DROP:    8. %VD:   .1
PROJECTED POWER FLOW:     25.1 KW      8.2 KVAR      26.4 KVA  PF: .95 LAGGING
LOSSES THRU TRANSF:       .0 KW     .1 KVAR     .1 KVA

LOAD   TO:  930 RICH SUB    FEEDER AMPS:     2 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     25.1 KW      8.2 KVAR      26.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA


==== BUS:  565 5-17 PRI   DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2375 %VD:  1.0
======================== PU BUS VOLTAGE:   .990        ANGLE:  -4.0 DEGREES
              PROJECTED SPECIAL BUS LOAD:      4.9 KW      1.9 KVAR

LOAD FROM:  555             FEEDER AMPS:    30 VOLTAGE DROP:    7. %VD:   .3
PROJECTED POWER FLOW:    117.9 KW     37.4 KVAR     123.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .3 KW       .3 KVAR        .4 KVA

LOAD   TO:  570 5-18 PRI    FEEDER AMPS:     2 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      7.8 KW      3.2 KVAR       8.5 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  575 F5 51       FEEDER AMPS:    27 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:    105.2 KW     32.2 KVAR     110.0 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR        .1 KVA
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  570 5-18 PRI   DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2375 %VD:  1.1
======================== PU BUS VOLTAGE:   .989       ANGLE:  -4.0 DEGREES
              PROJECTED SPECIAL BUS LOAD:      7.8 KW       3.2 KVAR

LOAD FROM:  565 5-17 PRI     FEEDER AMPS:     2 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      7.8 KW      3.2 KVAR      8.5 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  575 F5 51      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2373 %VD:  1.1
======================== PU BUS VOLTAGE:   .989       ANGLE:  -4.0 DEGREES
              PROJECTED SPECIAL BUS LOAD:      2.0 KW        .6 KVAR

LOAD FROM:  565 5-17 PRI     FEEDER AMPS:    27 VOLTAGE DROP:    2. %VD:    .1
PROJECTED POWER FLOW:    105.1 KW     32.2 KVAR    109.9 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR       .1 KVA

LOAD   TO:  580 F5 L85       FEEDER AMPS:    26 VOLTAGE DROP:    5. %VD:    .2
PROJECTED POWER FLOW:    103.1 KW     31.5 KVAR    107.8 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:         .2 KW       .2 KVAR       .2 KVA


==== BUS:  580 F5 L85     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2368 %VD:  1.3
======================== PU BUS VOLTAGE:   .987       ANGLE:  -4.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:      7.8 KW       3.2 KVAR

LOAD FROM:  575 F5 51        FEEDER AMPS:    26 VOLTAGE DROP:    5. %VD:    .2
PROJECTED POWER FLOW:    103.0 KW     31.4 KVAR    107.6 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:         .2 KW       .2 KVAR       .2 KVA

LOAD   TO:  585 F5 L87 UF1   FEEDER AMPS:     6 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     23.4 KW      7.8 KVAR     24.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  590 F5 L8911     FEEDER AMPS:    18 VOLTAGE DROP:    4. %VD:    .2
PROJECTED POWER FLOW:     71.8 KW     20.4 KVAR     74.7 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:         .1 KW       .0 KVAR       .1 KVA
```

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                    BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  585 F5 L87 UF1 DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2367 %VD:  1.4
======================== PU BUS VOLTAGE:   .986         ANGLE:  -4.1 DEGREES
             PROJECTED SPECIAL BUS LOAD:     23.3 KW        7.8 KVAR

LOAD FROM:  580 F5 L85        FEEDER AMPS:     6 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      23.3 KW      7.8 KVAR     24.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA


==== BUS:  590 F5 L8911   DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2364 %VD:  1.5
======================== PU BUS VOLTAGE:   .985         ANGLE:  -4.1 DEGREES
             PROJECTED SPECIAL BUS LOAD:     39.8 KW       10.7 KVAR

LOAD FROM:  580 F5 L85        FEEDER AMPS:    18 VOLTAGE DROP:    4. %VD:   .2
PROJECTED POWER FLOW:      71.7 KW     20.3 KVAR     74.5 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:          .1 KW       .0 KVAR       .1 KVA

LOAD   TO:  591 5-23 SEC      TRANSF AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .0 KW       .0 KVAR       .0 KVA  PF: .00 LAGGING
LOSSES THRU TRANSF:       .0 KW       .0 KVAR       .0 KVA

LOAD FROM:  593 5-24 SEC      TRANSF AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .0 KW       .0 KVAR       .0 KVA  PF: .00 LAGGING
LOSSES THRU TRANSF:       .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  595 F5 L8 25      FEEDER AMPS:     8 VOLTAGE DROP:    7. %VD:   .3
PROJECTED POWER FLOW:      31.9 KW      9.7 KVAR     33.4 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:          .1 KW       .0 KVAR       .1 KVA


==== BUS:  591 5-23 SEC   DESIGN VOLTAGE:   208  BUS VOLTAGE:   205 %VD:  1.5
======================== PU BUS VOLTAGE:   .985         ANGLE:  -4.1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  593 5-24 SEC   DESIGN VOLTAGE:   208  BUS VOLTAGE:   205 %VD:  1.5
======================== PU BUS VOLTAGE:   .985         ANGLE:  -4.1 DEGREES
**** NO LOAD SPECIFIED ****
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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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               BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  595 F5 L8 25   DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2357 %VD:  1.8
======================== PU BUS VOLTAGE:   .982       ANGLE:  -4.1 DEGREES
             PROJECTED SPECIAL BUS LOAD:      31.8 KW      9.6 KVAR

LOAD FROM:  590 F5 L8911     FEEDER AMPS:     8 VOLTAGE DROP:    7. %VD:   .3
PROJECTED POWER FLOW:      31.8 KW       9.6 KVAR     33.3 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:          .1 KW        .0 KVAR       .1 KVA


==== BUS:  600 O/H BUS    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2443 %VD: -1.8
======================== PU BUS VOLTAGE:  1.018       ANGLE:  -3.0 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  700 FDR 7      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2442 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017       ANGLE:  -3.0 DEGREES

LOAD FROM:   90 SWGR O      FEEDER AMPS:   122 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     488.8 KW     165.8 KVAR    516.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .1 KVAR       .3 KVA

LOAD   TO:  705 WELL9 POL   FEEDER AMPS:   122 VOLTAGE DROP:    1. %VD:   .1
PROJECTED POWER FLOW:     488.8 KW     165.8 KVAR    516.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .3 KVAR       .3 KVA


==== BUS:  705 WELL9 POL  DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2440 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017       ANGLE:  -3.0 DEGREES
             PROJECTED SPECIAL BUS LOAD:      42.4 KW     14.5 KVAR

LOAD FROM:  700 FDR 7       FEEDER AMPS:   122 VOLTAGE DROP:    1. %VD:   .1
PROJECTED POWER FLOW:     488.6 KW     165.5 KVAR    515.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .3 KVAR       .3 KVA

LOAD FROM:  707 7-1 SEC     TRANSF AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .0 KW         .0 KVAR       .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:       .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  709 F9 F73      FEEDER AMPS:   111 VOLTAGE DROP:    5. %VD:   .2
PROJECTED POWER FLOW:     446.3 KW     151.1 KVAR    471.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .7 KW        .9 KVAR      1.1 KVA
```

```
                 BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  707 7-1 SEC     DESIGN VOLTAGE:   480  BUS VOLTAGE:   488 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017        ANGLE:  -3.0 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  709 F9 F73      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2435 %VD: -1.5
======================== PU BUS VOLTAGE:  1.015        ANGLE:  -3.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:     85.5 KW     27.8 KVAR

LOAD FROM:  705 WELL9 POL     FEEDER AMPS:   111 VOLTAGE DROP:    5. %VD:   .2
PROJECTED POWER FLOW:      445.6 KW     150.2 KVAR     470.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .7 KW        .9 KVAR       1.1 KVA

LOAD   TO:  710 F7 L11        FEEDER AMPS:    90 VOLTAGE DROP:   19. %VD:   .8
PROJECTED POWER FLOW:      360.1 KW     122.4 KVAR     380.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          2.2 KW       2.9 KVAR       3.7 KVA


==== BUS:  710 F7 L11      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2416 %VD:  -.7
======================== PU BUS VOLTAGE:  1.007        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:     85.1 KW     28.4 KVAR

LOAD FROM:  709 F9 F73        FEEDER AMPS:    90 VOLTAGE DROP:   19. %VD:   .8
PROJECTED POWER FLOW:      357.9 KW     119.4 KVAR     377.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          2.2 KW       2.9 KVAR       3.7 KVA

LOAD   TO:  715 F7 L13        FEEDER AMPS:     5 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:       21.3 KW       7.1 KVAR      22.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  720 F713          FEEDER AMPS:    63 VOLTAGE DROP:    7. %VD:   .3
PROJECTED POWER FLOW:      251.5 KW      84.0 KVAR     265.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .5 KW        .7 KVAR        .9 KVA


==== BUS:  715 F7 L13      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2416 %VD:  -.6
======================== PU BUS VOLTAGE:  1.006        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:     21.3 KW      7.1 KVAR

LOAD FROM:  710 F7 L11        FEEDER AMPS:     5 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:       21.3 KW       7.1 KVAR      22.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .0 KW        .0 KVAR        .0 KVA
```

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                 BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  720 F713        DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2409 %VD:  -.4
======================== PU BUS VOLTAGE:  1.004         ANGLE:  -3.5 DEGREES
              PROJECTED SPECIAL BUS LOAD:       31.2 KW      10.1 KVAR

LOAD FROM:  710 F7 L11       FEEDER AMPS:     63 VOLTAGE DROP:    7. %VD:    .3
PROJECTED POWER FLOW:      251.0 KW      83.2 KVAR     264.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .5 KW        .7 KVAR        .9 KVA

LOAD   TO:  725 7-15 PRI     FEEDER AMPS:     55 VOLTAGE DROP:   14. %VD:    .6
PROJECTED POWER FLOW:      219.7 KW      73.2 KVAR     231.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          1.0 KW       1.3 KVAR        1.7 KVA


==== BUS:  725 7-15 PRI    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2395 %VD:   .2
======================== PU BUS VOLTAGE:   .998         ANGLE:  -3.8 DEGREES
              PROJECTED SPECIAL BUS LOAD:       91.6 KW      29.9 KVAR

LOAD FROM:  720 F713         FEEDER AMPS:     55 VOLTAGE DROP:   14. %VD:    .6
PROJECTED POWER FLOW:      218.7 KW      71.8 KVAR     230.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          1.0 KW       1.3 KVAR        1.7 KVA

LOAD   TO:  730 F7 L43       FEEDER AMPS:      3 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:       11.9 KW       4.0 KVAR      12.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  735 F7 L54       FEEDER AMPS:     29 VOLTAGE DROP:    2. %VD:    .1
PROJECTED POWER FLOW:      115.2 KW      38.0 KVAR     121.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .1 KW        .1 KVAR        .1 KVA


==== BUS:  730 F7 L43      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2395 %VD:   .2
======================== PU BUS VOLTAGE:   .998         ANGLE:  -3.8 DEGREES
              PROJECTED SPECIAL BUS LOAD:       11.9 KW       4.0 KVAR

LOAD FROM:  725 7-15 PRI     FEEDER AMPS:      3 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:       11.9 KW       4.0 KVAR      12.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .0 KW        .0 KVAR        .0 KVA
```

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  735 F7 L54     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2393 %VD:   .3
======================== PU BUS VOLTAGE:   .997       ANGLE:  -3.8 DEGREES
             PROJECTED SPECIAL BUS LOAD:     20.9 KW      7.0 KVAR

LOAD FROM:  725 7-15 PRI     FEEDER AMPS:    29 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     115.1 KW     37.9 KVAR     121.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .1 KVAR        .1 KVA

LOAD   TO:  740 7-17 PRI     FEEDER AMPS:     4 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      16.9 KW      5.0 KVAR      17.6 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  745              FEEDER AMPS:    20 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:      77.3 KW     25.9 KVAR      81.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .1 KVAR        .1 KVA


==== BUS:  740 7-17 PRI   DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2392 %VD:   .3
======================== PU BUS VOLTAGE:   .997       ANGLE:  -3.8 DEGREES
             PROJECTED SPECIAL BUS LOAD:     16.9 KW      5.0 KVAR

LOAD FROM:  735 F7 L54       FEEDER AMPS:     4 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      16.9 KW      5.0 KVAR      17.6 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA


==== BUS:  745            DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2390 %VD:   .4
======================== PU BUS VOLTAGE:   .996       ANGLE:  -3.8 DEGREES

LOAD FROM:  735 F7 L54       FEEDER AMPS:    20 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:      77.2 KW     25.8 KVAR      81.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .1 KVAR        .1 KVA

LOAD   TO:  750 F7 L72       FEEDER AMPS:     7 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      27.8 KW      8.9 KVAR      29.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  760 7-21 PRI     FEEDER AMPS:    13 VOLTAGE DROP:    4. %VD:   .2
PROJECTED POWER FLOW:      49.5 KW     16.9 KVAR      52.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .1 KVAR        .1 KVA
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD    TO:  770 7-23 PRI     FEEDER AMPS:     4 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     16.8 KW      5.9 KVAR     17.8 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  770 7-23 PRI   DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2385 %VD:   .6
======================== PU BUS VOLTAGE:   .994        ANGLE:  -3.9 DEGREES
              PROJECTED SPECIAL BUS LOAD:       4.9 KW      2.0 KVAR

LOAD FROM:  765 7-22 PRI     FEEDER AMPS:     4 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     16.8 KW      5.9 KVAR     17.8 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD    TO:  775 7-24 PRI     FEEDER AMPS:     3 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     11.8 KW      3.9 KVAR     12.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  775 7-24 PRI   DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2384 %VD:   .7
======================== PU BUS VOLTAGE:   .993        ANGLE:  -3.9 DEGREES
              PROJECTED SPECIAL BUS LOAD:      11.8 KW      3.9 KVAR

LOAD FROM:  770 7-23 PRI     FEEDER AMPS:     3 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     11.8 KW      3.9 KVAR     12.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  800 FDR 8      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2442 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017        ANGLE:  -3.0 DEGREES

LOAD FROM:   90 SWGR O       FEEDER AMPS:   102 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:    407.5 KW    144.4 KVAR    432.3 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .2 KW       .1 KVAR       .2 KVA

LOAD    TO:  805 F8 L11      FEEDER AMPS:   102 VOLTAGE DROP:   40. %VD:  1.7
PROJECTED POWER FLOW:    407.5 KW    144.4 KVAR    432.3 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:        5.1 KW      6.8 KVAR      8.5 KVA
```

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
****
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

```
==== BUS:  805 F8 L11    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2402 %VD:  -.1
======================== PU BUS VOLTAGE:  1.001       ANGLE:  -3.6 DEGREES
               PROJECTED SPECIAL BUS LOAD:     30.1 KW     10.0 KVAR

LOAD FROM:  800 FDR 8       FEEDER AMPS:   102 VOLTAGE DROP:   40. %VD:  1.7
PROJECTED POWER FLOW:     402.4 KW     137.6 KVAR     425.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         5.1 KW       6.8 KVAR       8.5 KVA

LOAD   TO:  810 F8 L23      FEEDER AMPS:    95 VOLTAGE DROP:   20. %VD:   .8
PROJECTED POWER FLOW:     372.3 KW     127.6 KVAR     393.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         2.4 KW       3.2 KVAR       4.0 KVA

==== BUS:  810 F8 L23    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2382 %VD:   .8
======================== PU BUS VOLTAGE:   .992       ANGLE:  -4.0 DEGREES
               PROJECTED SPECIAL BUS LOAD:     71.9 KW     23.6 KVAR

LOAD FROM:  805 F8 L11      FEEDER AMPS:    95 VOLTAGE DROP:   20. %VD:   .8
PROJECTED POWER FLOW:     369.9 KW     124.4 KVAR     390.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         2.4 KW       3.2 KVAR       4.0 KVA

LOAD   TO:  815 F8 L25      FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       4.2 KW       1.4 KVAR       4.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  817 F8 22       FEEDER AMPS:    75 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:     293.8 KW      99.4 KVAR     310.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW        .4 KVAR        .5 KVA

==== BUS:  815 F8 L25    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2382 %VD:   .8
======================== PU BUS VOLTAGE:   .992       ANGLE:  -4.0 DEGREES
               PROJECTED SPECIAL BUS LOAD:      4.2 KW      1.4 KVAR

LOAD FROM:  810 F8 L23      FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       4.2 KW       1.4 KVAR       4.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA
```

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                 BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD   TO:  905 STEP SEC      TRANSF AMPS:   109 VOLTAGE DROP:   16. %VD:   .7
PROJECTED POWER FLOW:     436.1 KW     153.5 KVAR    462.3 KVA  PF: .94 LAGGING
LOSSES THRU TRANSF:       1.1 KW      6.2 KVAR      6.3 KVA


==== BUS:  905 STEP SEC    DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7277 %VD: -1.1
======================== PU BUS VOLTAGE:  1.011        ANGLE:  -3.7 DEGREES

LOAD FROM:  900 FDR 9         TRANSF AMPS:    36 VOLTAGE DROP:   48. %VD:   .7
PROJECTED POWER FLOW:     435.0 KW     147.3 KVAR    459.2 KVA  PF: .95 LAGGING
LOSSES THRU TRANSF:       1.1 KW      6.2 KVAR      6.3 KVA

LOAD   TO:  910 F 96          FEEDER AMPS:    36 VOLTAGE DROP:    5. %VD:   .1
PROJECTED POWER FLOW:     435.0 KW     147.3 KVAR    459.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .3 KVAR        .4 KVA


==== BUS:  910 F 96        DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7272 %VD: -1.0
======================== PU BUS VOLTAGE:  1.010        ANGLE:  -3.7 DEGREES
              PROJECTED SPECIAL BUS LOAD:      18.2 KW       6.0 KVAR

LOAD FROM:  905 STEP SEC      FEEDER AMPS:    36 VOLTAGE DROP:    5. %VD:   .1
PROJECTED POWER FLOW:     434.8 KW     147.0 KVAR    458.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .3 KVAR        .4 KVA

LOAD   TO:  915 F910          FEEDER AMPS:    35 VOLTAGE DROP:    6. %VD:   .1
PROJECTED POWER FLOW:     416.6 KW     141.0 KVAR    439.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW        .4 KVAR        .4 KVA


==== BUS:  915 F910        DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7266 %VD:  -.9
======================== PU BUS VOLTAGE:  1.009        ANGLE:  -3.7 DEGREES
              PROJECTED SPECIAL BUS LOAD:      60.7 KW      20.0 KVAR

LOAD FROM:  910 F 96          FEEDER AMPS:    35 VOLTAGE DROP:    6. %VD:   .1
PROJECTED POWER FLOW:     416.3 KW     140.7 KVAR    439.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW        .4 KVAR        .4 KVA

LOAD   TO:  920 F940          FEEDER AMPS:    30 VOLTAGE DROP:   29. %VD:   .4
PROJECTED POWER FLOW:     355.6 KW     120.7 KVAR    375.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         1.1 KW       1.4 KVAR       1.8 KVA
```

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
****
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

```
==== BUS:  920 F940          DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7237 %VD:  -.5
======================== PU BUS VOLTAGE:  1.005       ANGLE:  -3.9 DEGREES
              PROJECTED SPECIAL BUS LOAD:      10.4 KW     3.4 KVAR

LOAD FROM:  915 F910         FEEDER AMPS:    30 VOLTAGE DROP:   29. %VD:   .4
PROJECTED POWER FLOW:      354.5 KW    119.3 KVAR    374.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          1.1 KW      1.4 KVAR      1.8 KVA

LOAD   TO:  945 F949 L1      FEEDER AMPS:    29 VOLTAGE DROP:    5. %VD:   .1
PROJECTED POWER FLOW:      344.2 KW    115.9 KVAR    363.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .2 KW       .2 KVAR       .3 KVA

==== BUS:  925 ()            DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7117 %VD:  1.2
======================== PU BUS VOLTAGE:   .988       ANGLE:  -4.1 DEGREES

LOAD FROM:  930 RICH SUB     FEEDER AMPS:     2 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:       25.1 KW      8.2 KVAR     26.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  935 9-8 PRI      FEEDER AMPS:     2 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:       25.1 KW      8.2 KVAR     26.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .0 KW       .0 KVAR       .0 KVA

==== BUS:  930 RICH SUB      DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7119 %VD:  1.1
======================== PU BUS VOLTAGE:   .989       ANGLE:  -4.1 DEGREES

LOAD FROM:  562 RS SEC       FEEDER AMPS:     2 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       25.1 KW      8.2 KVAR     26.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  925 ()           FEEDER AMPS:     2 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:       25.1 KW      8.2 KVAR     26.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .0 KW       .0 KVAR       .0 KVA
```

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

```
                    BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  935 9-8 PRI     DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7114 %VD:  1.2
======================== PU BUS VOLTAGE:    .988        ANGLE:  -4.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:     10.0 KW       3.3 KVAR

LOAD FROM:  925 ()          FEEDER AMPS:     2 VOLTAGE DROP:    3. %VD:    .0
PROJECTED POWER FLOW:      25.1 KW      8.2 KVAR     26.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  940 9-9 PRI     FEEDER AMPS:     1 VOLTAGE DROP:    8. %VD:    .1
PROJECTED POWER FLOW:      15.0 KW      4.9 KVAR     15.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA


==== BUS:  940 9-9 PRI     DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7106 %VD:  1.3
======================== PU BUS VOLTAGE:    .987        ANGLE:  -4.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:     15.0 KW       4.9 KVAR

LOAD FROM:  935 9-8 PRI     FEEDER AMPS:     1 VOLTAGE DROP:    8. %VD:    .1
PROJECTED POWER FLOW:      15.0 KW      4.9 KVAR     15.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA


==== BUS:  945 F949 L1     DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7232 %VD:  -.4
======================== PU BUS VOLTAGE:   1.004        ANGLE:  -3.9 DEGREES
              PROJECTED SPECIAL BUS LOAD:      5.4 KW       1.8 KVAR

LOAD FROM:  920 F940        FEEDER AMPS:    29 VOLTAGE DROP:    5. %VD:    .1
PROJECTED POWER FLOW:     344.0 KW    115.6 KVAR    362.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW       .2 KVAR       .3 KVA

LOAD   TO:  950 9-12 PRI    FEEDER AMPS:     1 VOLTAGE DROP:    2. %VD:    .0
PROJECTED POWER FLOW:       8.3 KW      2.7 KVAR      8.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  960 9-13 PRI    FEEDER AMPS:    28 VOLTAGE DROP:   32. %VD:    .4
PROJECTED POWER FLOW:     330.3 KW    111.1 KVAR    348.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         1.4 KW       .7 KVAR      1.6 KVA
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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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              BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  950 9-12 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7230 %VD:  -.4
======================== PU BUS VOLTAGE:  1.004       ANGLE:  -3.9 DEGREES
              PROJECTED SPECIAL BUS LOAD:      4.1 KW      1.4 KVAR

LOAD FROM:  945 F949 L1      FEEDER AMPS:     1 VOLTAGE DROP:    2. %VD:    .0
PROJECTED POWER FLOW:      8.3 KW      2.7 KVAR      8.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  955 9-11 PRI     FEEDER AMPS:       VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:      4.1 KW      1.4 KVAR      4.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  955 9-11 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7230 %VD:  -.4
======================== PU BUS VOLTAGE:  1.004       ANGLE:  -3.9 DEGREES
              PROJECTED SPECIAL BUS LOAD:      4.1 KW      1.4 KVAR

LOAD FROM:  950 9-12 PRI     FEEDER AMPS:       VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:      4.1 KW      1.4 KVAR      4.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  960 9-13 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7200 %VD:    .0
======================== PU BUS VOLTAGE:  1.000       ANGLE:  -4.0 DEGREES
              PROJECTED SPECIAL BUS LOAD:     17.8 KW      5.8 KVAR

LOAD FROM:  945 F949 L1      FEEDER AMPS:    28 VOLTAGE DROP:   32. %VD:    .4
PROJECTED POWER FLOW:    328.9 KW    110.5 KVAR    346.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:        1.4 KW       .7 KVAR      1.6 KVA

LOAD   TO:  963 9-14 PRI     FEEDER AMPS:    26 VOLTAGE DROP:  105. %VD:   1.5
PROJECTED POWER FLOW:    311.1 KW    104.6 KVAR    328.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:        4.4 KW      2.1 KVAR      4.8 KVA


==== BUS:  963 9-14 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7095 %VD:   1.5
======================== PU BUS VOLTAGE:   .985       ANGLE:  -4.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:     17.3 KW      5.7 KVAR

LOAD FROM:  960 9-13 PRI     FEEDER AMPS:    26 VOLTAGE DROP:  105. %VD:   1.5
PROJECTED POWER FLOW:    306.7 KW    102.5 KVAR    323.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:        4.4 KW      2.1 KVAR      4.8 KVA
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD   TO:  966 9-15 PRI     FEEDER AMPS:    25 VOLTAGE DROP:   29. %VD:   .4
PROJECTED POWER FLOW:     289.4 KW     96.8 KVAR     305.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         1.1 KW       .5 KVAR       1.2 KVA


==== BUS:  966 9-15 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7066 %VD:  1.9
========================= PU BUS VOLTAGE:    .981        ANGLE:  -4.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:       2.0 KW         .7 KVAR

LOAD FROM:  963 9-14 PRI     FEEDER AMPS:    25 VOLTAGE DROP:   29. %VD:   .4
PROJECTED POWER FLOW:     288.3 KW     96.3 KVAR     304.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         1.1 KW       .5 KVAR       1.2 KVA

LOAD   TO:  969 SW UP        FEEDER AMPS:    25 VOLTAGE DROP:    8. %VD:   .1
PROJECTED POWER FLOW:     286.3 KW     95.6 KVAR     301.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW       .1 KVAR        .3 KVA


==== BUS:  969 SW UP      DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7058 %VD:  2.0
========================= PU BUS VOLTAGE:    .980        ANGLE:  -4.1 DEGREES

LOAD FROM:  966 9-15 PRI     FEEDER AMPS:    25 VOLTAGE DROP:    8. %VD:   .1
PROJECTED POWER FLOW:     286.0 KW     95.5 KVAR     301.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW       .1 KVAR        .3 KVA

LOAD   TO:  972 SW DOWN      FEEDER AMPS:    25 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     286.0 KW     95.5 KVAR     301.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA


==== BUS:  972 SW DOWN    DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7058 %VD:  2.0
========================= PU BUS VOLTAGE:    .980        ANGLE:  -4.1 DEGREES

LOAD FROM:  969 SW UP        FEEDER AMPS:    25 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     286.0 KW     95.5 KVAR     301.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  975 9-16 PRI     FEEDER AMPS:    25 VOLTAGE DROP:  109. %VD:  1.5
PROJECTED POWER FLOW:     286.0 KW     95.5 KVAR     301.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         4.2 KW      2.0 KVAR       4.7 KVA
```

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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               BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  975 9-16 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  6949 %VD:  3.5
======================== PU BUS VOLTAGE:   .965        ANGLE:  -4.2 DEGREES

LOAD FROM:  972 SW DOWN     FEEDER AMPS:    25 VOLTAGE DROP:  109. %VD:  1.5
PROJECTED POWER FLOW:     281.8 KW     93.5 KVAR    296.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         4.2 KW      2.0 KVAR      4.7 KVA

LOAD   TO:  977 9-19 PRI    FEEDER AMPS:     1 VOLTAGE DROP:    7. %VD:   .1
PROJECTED POWER FLOW:      15.3 KW      5.0 KVAR     16.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  980             FEEDER AMPS:    23 VOLTAGE DROP:   43. %VD:   .6
PROJECTED POWER FLOW:     266.5 KW     88.4 KVAR    280.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         1.6 KW       .8 KVAR      1.7 KVA


==== BUS:  977 9-19 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  6942 %VD:  3.6
======================== PU BUS VOLTAGE:   .964        ANGLE:  -4.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:       15.3 KW       5.0 KVAR

LOAD FROM:  975 9-16 PRI    FEEDER AMPS:     1 VOLTAGE DROP:    7. %VD:   .1
PROJECTED POWER FLOW:      15.3 KW      5.0 KVAR     16.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA


==== BUS:  980            DESIGN VOLTAGE:  7200  BUS VOLTAGE:  6906 %VD:  4.1
======================== PU BUS VOLTAGE:   .959        ANGLE:  -4.3 DEGREES

LOAD FROM:  975 9-16 PRI    FEEDER AMPS:    23 VOLTAGE DROP:   43. %VD:   .6
PROJECTED POWER FLOW:     264.9 KW     87.7 KVAR    279.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         1.6 KW       .8 KVAR      1.7 KVA

LOAD   TO:  982 9-20 PRI    FEEDER AMPS:       VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:       5.7 KW      1.9 KVAR      6.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  983 9-25 PRI    FEEDER AMPS:    23 VOLTAGE DROP:   72. %VD:  1.0
PROJECTED POWER FLOW:     259.2 KW     85.8 KVAR    273.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         2.6 KW      1.2 KVAR      2.9 KVA
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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
****

VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH = 4.00 %   BUS = 5.00

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==== BUS:  982 9-20 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  6906 %VD:  4.1
======================== PU BUS VOLTAGE:   .959        ANGLE:  -4.3 DEGREES
              PROJECTED SPECIAL BUS LOAD:      5.7 KW       1.9 KVAR

LOAD FROM:  980            FEEDER AMPS:        VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:      5.7 KW       1.9 KVAR      6.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR       .0 KVA


==== BUS:  983 9-25 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  6834 %VD:  5.1$
======================== PU BUS VOLTAGE:   .949        ANGLE:  -4.3 DEGREES
              PROJECTED SPECIAL BUS LOAD:    146.5 KW      48.2 KVAR

LOAD FROM:  980            FEEDER AMPS:     23 VOLTAGE DROP:   72. %VD:  1.0
PROJECTED POWER FLOW:    256.6 KW      84.6 KVAR    270.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:        2.6 KW       1.2 KVAR      2.9 KVA

LOAD   TO:  984 9-25 SEC     TRANSF AMPS:        VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:        .0 KW        .0 KVAR       .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:      .0 KW       .0 KVAR      .0 KVA

LOAD   TO:  985 9-34 PRI     FEEDER AMPS:     10 VOLTAGE DROP:   10. %VD:    .1
PROJECTED POWER FLOW:    110.1 KW      36.4 KVAR    116.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .2 KW        .1 KVAR       .2 KVA


==== BUS:  984 9-25 SEC   DESIGN VOLTAGE:   208  BUS VOLTAGE:   197 %VD:  5.1$
======================== PU BUS VOLTAGE:   .949        ANGLE:  -4.3 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  985 9-34 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  6824 %VD:  5.2$
======================== PU BUS VOLTAGE:   .948        ANGLE:  -4.3 DEGREES
              PROJECTED SPECIAL BUS LOAD:      9.6 KW       3.2 KVAR

LOAD FROM:  983 9-25 PRI     FEEDER AMPS:     10 VOLTAGE DROP:   10. %VD:    .1
PROJECTED POWER FLOW:    110.0 KW      36.3 KVAR    115.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .2 KW        .1 KVAR       .2 KVA

LOAD   TO:  987            FEEDER AMPS:      9 VOLTAGE DROP:   30. %VD:    .4
PROJECTED POWER FLOW:    100.4 KW      33.2 KVAR    105.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .4 KW        .2 KVAR       .5 KVA
```

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
****

VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

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==== BUS:  987               DESIGN VOLTAGE:  7200  BUS VOLTAGE:  6794 %VD:  5.6$
======================== PU BUS VOLTAGE:   .944          ANGLE:  -4.4 DEGREES

LOAD FROM:  985 9-34 PRI     FEEDER AMPS:     9 VOLTAGE DROP:   30. %VD:   .4
PROJECTED POWER FLOW:     99.9 KW     33.0 KVAR     105.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .4 KW       .2 KVAR        .5 KVA

LOAD   TO:  990 9-26 PRI     FEEDER AMPS:     4 VOLTAGE DROP:   19. %VD:   .3
PROJECTED POWER FLOW:     41.0 KW     13.5 KVAR      43.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR        .1 KVA

LOAD   TO:  992              FEEDER AMPS:     5 VOLTAGE DROP:   75. %VD:  1.0
PROJECTED POWER FLOW:     58.9 KW     19.5 KVAR      62.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .6 KW       .3 KVAR        .7 KVA

==== BUS:  990 9-26 PRI      DESIGN VOLTAGE:  7200  BUS VOLTAGE:  6775 %VD:  5.9$
======================== PU BUS VOLTAGE:   .941          ANGLE:  -4.4 DEGREES
               PROJECTED SPECIAL BUS LOAD:     40.9 KW       13.4 KVAR

LOAD FROM:  987              FEEDER AMPS:     4 VOLTAGE DROP:   19. %VD:   .3
PROJECTED POWER FLOW:     40.9 KW     13.4 KVAR      43.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR        .1 KVA

==== BUS:  992               DESIGN VOLTAGE:  7200  BUS VOLTAGE:  6719 %VD:  6.7$
======================== PU BUS VOLTAGE:   .933          ANGLE:  -4.5 DEGREES

LOAD FROM:  987              FEEDER AMPS:     5 VOLTAGE DROP:   75. %VD:  1.0
PROJECTED POWER FLOW:     58.3 KW     19.2 KVAR      61.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .6 KW       .3 KVAR        .7 KVA

LOAD   TO:  995 9-30 PRI     FEEDER AMPS:     4 VOLTAGE DROP:   52. %VD:   .7
PROJECTED POWER FLOW:     40.0 KW     13.1 KVAR      42.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .3 KW       .0 KVAR        .3 KVA

LOAD   TO:  997 9-32 PRI     FEEDER AMPS:     2 VOLTAGE DROP:    4. %VD:   .1
PROJECTED POWER FLOW:     18.3 KW      6.1 KVAR      19.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA
```

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  995 9-30 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  6667 %VD:  7.4$
======================== PU BUS VOLTAGE:   .926       ANGLE:  -4.4 DEGREES
             PROJECTED SPECIAL BUS LOAD:     39.7 KW      13.0 KVAR

LOAD FROM:  992            FEEDER AMPS:     4 VOLTAGE DROP:   52. %VD:   .7
PROJECTED POWER FLOW:     39.7 KW     13.0 KVAR     41.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .3 KW       .0 KVAR       .3 KVA


==== BUS:  997 9-32 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  6715 %VD:  6.7$
======================== PU BUS VOLTAGE:   .933       ANGLE:  -4.5 DEGREES
             PROJECTED SPECIAL BUS LOAD:     18.3 KW       6.1 KVAR

LOAD FROM:  992            FEEDER AMPS:     2 VOLTAGE DROP:    4. %VD:   .1
PROJECTED POWER FLOW:     18.3 KW      6.1 KVAR     19.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA
```

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BUS DATA SUMMARY
****

BUS#	NAME	BASE VOLT	PU VOLT	BUS#	NAME	BASE VOLT	PU VOLT
10	GEN G1	2400.00	1.018	20	GEN G2	2400.00	1.018
30	GEN G3	2400.00	1.018	40	GEN G4	2400.00	1.018
50	GEN G5	2400.00	1.018	60	SWGR S	2400.00	1.018
62	SS-1 SEC	480.00	1.018	64	MCC 4&5	480.00	1.018
66	SM1A BLUE	2400.00	1.018	68	BLUE SSS	480.00	1.018
70	SWGR N	2400.00	1.018	80	UTILITY	24900.00	1.000
85	T1 SEC	2400.00	1.018	90	SWGR O	2400.00	1.018
100	FDR 1	2400.00	1.017	105	F1F12 14	2400.00	.999
110	F1 L14	2400.00	.996	115	F1 L15	2400.00	.996
120	F1 L31	2400.00	.992	121	F1 L63	2400.00	.989
122	F1 L64	2400.00	.989	125	F1 L67	2400.00	.989
130	F1 L613	2400.00	.988	135	F1 L68	2400.00	.989
200	FDR 2	2400.00	1.017	205		2400.00	1.010
210	2-3 PRI	2400.00	1.009	215	2-4 PRI	2400.00	1.009
220	2-5 PRI	2400.00	1.009	225	2-3 SEC	480.00	1.009
230	2-4 SEC	208.00	1.009	235	F5 F29	2400.00	1.008
236	F2 F211	2400.00	1.007	240	F1 F213	2400.00	1.006
300	FDR 3	2400.00	1.017	301	F8 F311	2400.00	1.014
303	F713	2400.00	1.013	305	F8 F311	2400.00	1.011
310	F3 19	2400.00	1.007	400	FDR 4	2400.00	1.017
401	4-1 PRI	2400.00	1.015	403	F1 F45	2400.00	1.013
405	F4 10	2400.00	1.011	410	F417 UF1	2400.00	1.007
415	4-6 SEC	208.00	1.007	500	FDR 5	2400.00	1.017
505	F4 F5 F6UF	2400.00	1.014	510	5-1 PRI	2400.00	1.013
512	5-3 PRI	2400.00	1.005	514	5-5 PRI	2400.00	1.005
515	F5 L24	2400.00	1.000	520	5-6 PRI	2400.00	.999
525	F5 L31	2400.00	.999	530	F5 L39	2400.00	.999
531	F3 L41	2400.00	.998	535	F537 L5	2400.00	.996
540	F5 L5 UF1	2400.00	.996	545	F5 L56 UF1	2400.00	.995
547	5-16 SEC	208.00	.995	550	F5 L55	2400.00	.996
555		2400.00	.993	560	RICH SUB	2400.00	.990
562	RS SEC	7200.00	.989	565	5-17 PRI	2400.00	.990
570	5-18 PRI	2400.00	.989	575	F5 51	2400.00	.989
580	F5 L85	2400.00	.987	585	F5 L87 UF1	2400.00	.986
590	F5 L8911	2400.00	.985	591	5-23 SEC	208.00	.985
593	5-24 SEC	208.00	.985	595	F5 L8 25	2400.00	.982
600	O/H BUS	2400.00	1.018	700	FDR 7	2400.00	1.017
705	WELL9 POL	2400.00	1.017	707	7-1 SEC	480.00	1.017
709	F9 F73	2400.00	1.015	710	F7 L11	2400.00	1.007
715	F7 L13	2400.00	1.006	720	F713	2400.00	1.004

BALANCED VOLTAGE DROP AND LOAD FLOW BUS DATA SUMMARY
****

BUS#	NAME	BASE VOLT	PU VOLT	BUS#	NAME	BASE VOLT	PU VOLT
725	7-15 PRI	2400.00	.998	730	F7 L43	2400.00	.998
735	F7 L54	2400.00	.997	740	7-17 PRI	2400.00	.997
745		2400.00	.996	750	F7 L72	2400.00	.996
755	F7-33	2400.00	.996	760	7-21 PRI	2400.00	.994
765	7-22 PRI	2400.00	.994	770	7-23 PRI	2400.00	.994
775	7-24 PRI	2400.00	.993	800	FDR 8	2400.00	1.017
805	F8 L11	2400.00	1.001	810	F8 L23	2400.00	.992
815	F8 L25	2400.00	.992	817	F8 22	2400.00	.991
820	F8 30 UF1	2400.00	.985	825	8-22 PRI	2400.00	.979
900	FDR 9	2400.00	1.017	905	STEP SEC	7200.00	1.011
910	F 96	7200.00	1.010	915	F910	7200.00	1.009
920	F940	7200.00	1.005	925	()	7200.00	.988
930	RICH SUB	7200.00	.989	935	9-8 PRI	7200.00	.988
940	9-9 PRI	7200.00	.987	945	F949 L1	7200.00	1.004
950	9-12 PRI	7200.00	1.004	955	9-11 PRI	7200.00	1.004
960	9-13 PRI	7200.00	1.000	963	9-14 PRI	7200.00	.985
966	9-15 PRI	7200.00	.981	969	SW UP	7200.00	.980
972	SW DOWN	7200.00	.980	975	9-16 PRI	7200.00	.965
977	9-19 PRI	7200.00	.964	980		7200.00	.959
982	9-20 PRI	7200.00	.959	983	9-25 PRI	7200.00	.949
984	9-25 SEC	208.00	.949	985	9-34 PRI	7200.00	.948
987		7200.00	.944	990	9-26 PRI	7200.00	.941
992		7200.00	.933	995	9-30 PRI	7200.00	.926
997	9-32 PRI	7200.00	.933				

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
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FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
10	GEN G1	60	SWGR S	FDR	.03	236.34	1000.00	50.83
20	GEN G2	60	SWGR S	FDR	.00	.00	.00	.00
30	GEN G3	60	SWGR S	FDR	.00	.00	.00	.00
40	GEN G4	70	SWGR N	FDR	.00	.00	.00	.00
50	GEN G5	70	SWGR N	FDR	.00	.00	.00	.00
60	SWGR S	10	GEN G1	FDR	.03	236.34	999.75	50.83
60	SWGR S	20	GEN G2	FDR	.00	.00	.00	.00
60	SWGR S	30	GEN G3	FDR	.00	.00	.00	.00
60	SWGR S	62	SS-1 SEC	TX2	.01	.11	.48	UNKNOW
60	SWGR S	66	SM1A BLUE	FDR	.00	.17	.74	.04
60	SWGR S	70	SWGR N	FDR	.01	317.30	1342.21	68.24
60	SWGR S	100	FDR 1	FDR	.06	136.43	577.11	59.32
60	SWGR S	200	FDR 2	FDR	.05	133.46	564.54	58.03

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
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FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
60	SWGR S	300	FDR 3	FDR	.04	92.96	393.22	40.42
60	SWGR S	400	FDR 4	FDR	.04	103.70	438.67	45.09
60	SWGR S	500	FDR 5	FDR	.03	65.44	276.83	28.45
62	SS-1 SEC	60	SWGR S	TX2	.01	.57	.48	UNKNOW
62	SS-1 SEC	64	MCC 4&5	FDR	.00	.57	.48	.12
64	MCC 4&5	62	SS-1 SEC	FDR	.00	.57	.48	.12
64	MCC 4&5	68	BLUE SSS	FDR	.00	.87	.74	.19
64	MCC 4&5	90	SWGR O	TX2	.01	1.44	1.22	UNKNOW
66	SM1A BLUE	60	SWGR S	FDR	.00	.17	.74	.04
66	SM1A BLUE	68	BLUE SSS	TX2	.01	.17	.74	UNKNOW
68	BLUE SSS	64	MCC 4&5	FDR	.00	.87	.74	.19
68	BLUE SSS	66	SM1A BLUE	TX2	.01	.87	.74	UNKNOW
70	SWGR N	40	GEN G4	FDR	.00	.00	.00	.00
70	SWGR N	50	GEN G5	FDR	.00	.00	.00	.00
70	SWGR N	60	SWGR S	FDR	.01	317.30	1342.29	68.24
70	SWGR N	90	SWGR O	FDR	.01	317.30	1342.29	85.76
80	UTILITY	85	T1 SEC	TX2	-1.81	65.61	2829.48	UNKNOW
85	T1 SEC	80	UTILITY	TX2	-1.81	646.64	2736.62	UNKNOW
85	T1 SEC	90	SWGR O	FDR	.03	646.64	2736.62	174.77
90	SWGR O	64	MCC 4&5	TX2	.01	.29	1.22	UNKNOW
90	SWGR O	70	SWGR N	FDR	.01	317.30	1342.48	85.76
90	SWGR O	85	T1 SEC	FDR	.03	646.64	2735.86	174.77
90	SWGR O	600	O/H BUS	FDR	.00	.00	.00	.00
90	SWGR O	700	FDR 7	FDR	.05	122.07	516.45	53.07
90	SWGR O	800	FDR 8	FDR	.04	102.22	432.47	44.44
90	SWGR O	900	FDR 9	FDR	.04	109.31	462.49	47.53
100	FDR 1	60	SWGR S	FDR	.06	136.43	576.79	59.32
100	FDR 1	105	F1F12 14	FDR	1.83	136.43	576.79	38.22
105	F1F12 14	100	FDR 1	FDR	1.83	136.43	566.41	38.22
105	F1F12 14	110	F1 L14	FDR	.24	134.19	557.11	37.59
110	F1 L14	105	F1F12 14	FDR	.24	134.19	555.77	37.59
110	F1 L14	115	F1 L15	FDR	.02	6.29	26.05	1.76
110	F1 L14	120	F1 L31	FDR	.44	122.59	507.75	34.34
115	F1 L15	110	F1 L14	FDR	.02	6.29	26.05	1.76
120	F1 L31	110	F1 L14	FDR	.44	122.59	505.52	34.34
120	F1 L31	121	F1 L63	FDR	.27	66.83	275.56	18.72
121	F1 L63	120	F1 L31	FDR	.27	66.83	274.82	18.72
121	F1 L63	122	F1 L64	FDR	.04	24.47	100.64	6.85
121	F1 L63	125	F1 L67	FDR	.05	26.78	110.11	7.50
122	F1 L64	121	F1 L63	FDR	.04	24.47	100.60	6.85

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
125	F1 L67	121	F1 L63	FDR	.05	26.78	110.06	7.50
125	F1 L67	130	F1 L613	FDR	.05	7.74	31.83	2.17
125	F1 L67	135	F1 L68	FDR	.01	3.54	14.53	.99
130	F1 L613	125	F1 L67	FDR	.05	7.74	31.82	2.17
135	F1 L68	125	F1 L67	FDR	.01	3.54	14.53	.99
200	FDR 2	60	SWGR S	FDR	.05	133.46	564.24	58.03
200	FDR 2	205		FDR	.71	133.46	564.24	37.38
205		200	FDR 2	FDR	.71	133.46	560.29	37.38
205		210	2-3 PRI	FDR	.08	59.79	251.02	16.75
205		235	F5 F29	FDR	.20	56.07	235.40	15.71
210	2-3 PRI	205		FDR	.08	59.79	250.82	16.75
210	2-3 PRI	215	2-4 PRI	FDR	.02	37.30	156.47	10.45
210	2-3 PRI	225	2-3 SEC	TX2	.00	.00	.00	UNKNOW
215	2-4 PRI	210	2-3 PRI	FDR	.02	37.30	156.44	10.45
215	2-4 PRI	220	2-5 PRI	FDR	.03	14.81	62.12	4.15
215	2-4 PRI	230	2-4 SEC	TX2	.00	.00	.00	UNKNOW
220	2-5 PRI	215	2-4 PRI	FDR	.03	14.81	62.10	4.15
225	2-3 SEC	210	2-3 PRI	TX2	.00	.00	.00	UNKNOW
230	2-4 SEC	215	2-4 PRI	TX2	.00	.00	.00	UNKNOW
235	F5 F29	205		FDR	.20	56.07	234.94	15.71
235	F5 F29	236	F2 F211	FDR	.10	44.88	188.03	12.57
236	F2 F211	235	F5 F29	FDR	.10	44.88	187.85	12.57
236	F2 F211	240	F1 F213	FDR	.05	22.43	93.90	6.28
240	F1 F213	236	F2 F211	FDR	.05	22.43	93.85	6.28
300	FDR 3	60	SWGR S	FDR	.04	92.96	393.08	40.42
300	FDR 3	301	F8 F311	FDR	.33	92.96	393.08	26.04
301	F8 F311	300	FDR 3	FDR	.33	92.96	391.80	26.04
301	F8 F311	303	F713	FDR	.08	45.22	190.57	12.67
303	F713	301	F8 F311	FDR	.08	45.22	190.42	12.67
303	F713	305	F8 F311	FDR	.16	45.22	190.42	12.67
305	F8 F311	303	F713	FDR	.16	45.22	190.12	12.67
305	F8 F311	310	F3 19	FDR	.44	41.37	173.94	11.59
310	F3 19	305	F8 F311	FDR	.44	41.37	173.18	11.59
400	FDR 4	60	SWGR S	FDR	.04	103.70	438.48	45.09
400	FDR 4	401	4-1 PRI	FDR	.23	103.70	438.48	29.05
401	4-1 PRI	400	FDR 4	FDR	.23	103.70	437.49	29.05
401	4-1 PRI	403	F1 F45	FDR	.19	84.40	356.06	23.64
403	F1 F45	401	4-1 PRI	FDR	.19	84.40	355.40	23.64
403	F1 F45	405	F4 10	FDR	.24	53.16	223.85	14.89
405	F4 10	403	F1 F45	FDR	.24	53.16	223.33	14.89

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
405	F4 10	410	F417 UF1	FDR	.32	36.48	153.25	10.22
410	F417 UF1	405	F4 10	FDR	.32	36.48	152.75	10.22
410	F417 UF1	415	4-6 SEC	TX2	.00	.00	.00	UNKNOW
415	4-6 SEC	410	F417 UF1	TX2	.00	.00	.00	UNKNOW
500	FDR 5	60	SWGR S	FDR	.03	65.44	276.76	28.45
500	FDR 5	505	F4 F5 F6UF	FDR	.37	65.44	276.76	18.33
505	F4 F5 F6UF	500	FDR 5	FDR	.37	65.44	275.76	18.33
505	F4 F5 F6UF	510	5-1 PRI	FDR	.02	7.94	33.46	2.22
505	F4 F5 F6UF	512	5-3 PRI	FDR	.83	57.51	242.31	16.11
510	5-1 PRI	505	F4 F5 F6UF	FDR	.02	7.94	33.46	2.22
512	5-3 PRI	505	F4 F5 F6UF	FDR	.83	57.51	240.33	16.11
512	5-3 PRI	514	5-5 PRI	FDR	.01	1.30	5.44	.36
512	5-3 PRI	515	F5 L24	FDR	.56	52.61	219.87	14.74
514	5-5 PRI	512	5-3 PRI	FDR	.01	1.30	5.44	.36
515	F5 L24	512	5-3 PRI	FDR	.56	52.61	218.63	14.74
515	F5 L24	520	5-6 PRI	FDR	.04	1.29	5.37	1.23
515	F5 L24	525	F5 L31	FDR	.09	49.24	204.65	13.79
520	5-6 PRI	515	F5 L24	FDR	.04	1.29	5.37	1.23
525	F5 L31	515	F5 L24	FDR	.09	49.24	204.47	13.79
525	F5 L31	530	F5 L39	FDR	.02	1.28	5.33	.36
525	F5 L31	531	F3 L41	FDR	.11	24.24	100.64	6.79
525	F5 L31	535	F537 L5	FDR	.27	21.65	89.90	6.06
530	F5 L39	525	F5 L31	FDR	.02	1.28	5.33	.36
531	F3 L41	525	F5 L31	FDR	.11	24.24	100.53	6.79
531	F3 L41	535	F537 L5	FDR	.16	20.21	83.84	5.66
535	F537 L5	525	F5 L31	FDR	.27	21.65	89.66	6.06
535	F537 L5	531	F3 L41	FDR	.16	20.21	83.71	5.66
535	F537 L5	540	F5 L5 UF1	FDR	.01	4.09	16.94	1.15
535	F537 L5	555		FDR	.36	36.50	151.14	13.22
540	F5 L5 UF1	535	F537 L5	FDR	.01	4.09	16.94	1.15
540	F5 L5 UF1	545	F5 L56 UF1	FDR	.14	3.03	12.53	1.65
540	F5 L5 UF1	550	F5 L55	FDR	.01	.54	2.22	.15
545	F5 L56 UF1	540	F5 L5 UF1	FDR	.14	3.03	12.52	1.65
545	F5 L56 UF1	547	5-16 SEC	TX2	.00	.00	.00	UNKNOW
547	5-16 SEC	545	F5 L56 UF1	TX2	.00	.00	.00	UNKNOW
550	F5 L55	540	F5 L5 UF1	FDR	.01	.54	2.22	.15
555		535	F537 L5	FDR	.36	36.50	150.59	13.22
555		560	RICH SUB	FDR	.26	6.43	26.52	2.33
555		565	5-17 PRI	FDR	.30	30.07	124.07	10.90
560	RICH SUB	555		FDR	.26	6.43	26.45	2.33

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
560	RICH SUB	562	RS SEC	TX2	.12	6.43	26.45	UNKNOW
562	RS SEC	560	RICH SUB	TX2	.12	2.14	26.42	UNKNOW
562	RS SEC	930	RICH SUB	FDR	.00	2.14	26.42	1.53
565	5-17 PRI	555		FDR	.30	30.07	123.69	10.90
565	5-17 PRI	570	5-18 PRI	FDR	.01	2.06	8.47	.75
565	5-17 PRI	575	F5 51	FDR	.10	26.74	110.01	9.69
570	5-18 PRI	565	5-17 PRI	FDR	.01	2.06	8.46	.75
575	F5 51	565	5-17 PRI	FDR	.10	26.74	109.90	9.69
575	F5 51	580	F5 L85	FDR	.19	26.24	107.84	9.51
580	F5 L85	575	F5 51	FDR	.19	26.24	107.63	9.51
580	F5 L85	585	F5 L87 UF1	FDR	.03	6.00	24.62	2.17
580	F5 L85	590	F5 L8911	FDR	.15	18.20	74.65	13.00
585	F5 L87 UF1	580	F5 L85	FDR	.03	6.00	24.61	2.17
590	F5 L8911	580	F5 L85	FDR	.15	18.20	74.54	13.00
590	F5 L8911	591	5-23 SEC	TX2	.00	.00	.00	UNKNOW
590	F5 L8911	593	5-24 SEC	TX2	.00	.00	.00	UNKNOW
590	F5 L8911	595	F5 L8 25	FDR	.31	8.15	33.36	5.82
591	5-23 SEC	590	F5 L8911	TX2	.00	.00	.00	UNKNOW
593	5-24 SEC	590	F5 L8911	TX2	.00	.00	.00	UNKNOW
595	F5 L8 25	590	F5 L8911	FDR	.31	8.15	33.25	5.82
600	O/H BUS	90	SWGR O	FDR	.00	.00	.00	.00
700	FDR 7	90	SWGR O	FDR	.05	122.07	516.19	53.07
700	FDR 7	705	WELL9 POL	FDR	.05	122.07	516.19	34.19
705	WELL9 POL	700	FDR 7	FDR	.05	122.07	515.92	34.19
705	WELL9 POL	707	7-1 SEC	TX2	.00	.00	.00	UNKNOW
705	WELL9 POL	709	F9 F73	FDR	.20	111.47	471.13	31.22
707	7-1 SEC	705	WELL9 POL	TX2	.00	.00	.00	UNKNOW
709	F9 F73	705	WELL9 POL	FDR	.20	111.47	470.21	31.22
709	F9 F73	710	F7 L11	FDR	.80	90.16	380.34	25.26
710	F7 L11	709	F9 F73	FDR	.80	90.16	377.32	25.26
710	F7 L11	715	F7 L13	FDR	.02	5.36	22.43	1.50
710	F7 L11	720	F713	FDR	.28	63.36	265.15	17.75
715	F7 L13	710	F7 L11	FDR	.02	5.36	22.42	1.50
720	F713	710	F7 L11	FDR	.28	63.36	264.41	17.75
720	F713	725	7-15 PRI	FDR	.59	55.49	231.59	15.54
725	7-15 PRI	720	F713	FDR	.59	55.49	230.22	15.54
725	7-15 PRI	730	F7 L43	FDR	.02	3.04	12.60	.85
725	7-15 PRI	735	F7 L54	FDR	.09	29.23	121.25	8.19
730	F7 L43	725	7-15 PRI	FDR	.02	3.04	12.59	.85
735	F7 L54	725	7-15 PRI	FDR	.09	29.23	121.14	8.19

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
735	F7 L54	740	7-17 PRI	FDR	.03	4.25	17.61	1.19
735	F7 L54	745		FDR	.11	19.67	81.53	5.51
740	7-17 PRI	735	F7 L54	FDR	.03	4.25	17.61	1.19
745		735	F7 L54	FDR	.11	19.67	81.44	5.51
745		750	F7 L72	FDR	.03	7.04	29.16	1.97
745		760	7-21 PRI	FDR	.16	12.63	52.28	3.54
750	F7 L72	745		FDR	.03	7.04	29.16	1.97
750	F7 L72	755	F7-33	FDR	.01	1.74	7.22	.49
755	F7-33	750	F7 L72	FDR	.01	1.74	7.22	.49
760	7-21 PRI	745		FDR	.16	12.63	52.19	3.54
760	7-21 PRI	765	7-22 PRI	FDR	.05	9.60	39.69	2.69
765	7-22 PRI	760	7-21 PRI	FDR	.05	9.60	39.67	2.69
765	7-22 PRI	770	7-23 PRI	FDR	.03	4.31	17.80	1.21
770	7-23 PRI	765	7-22 PRI	FDR	.03	4.31	17.80	1.21
770	7-23 PRI	775	7-24 PRI	FDR	.02	3.02	12.49	.85
775	7-24 PRI	770	7-23 PRI	FDR	.02	3.02	12.48	.85
800	FDR 8	90	SWGR O	FDR	.04	102.22	432.30	44.44
800	FDR 8	805	F8 L11	FDR	1.65	102.22	432.30	28.63
805	F8 L11	800	FDR 8	FDR	1.65	102.22	425.27	28.63
805	F8 L11	810	F8 L23	FDR	.85	94.60	393.60	26.50
810	F8 L23	805	F8 L11	FDR	.85	94.60	390.27	26.50
810	F8 L23	815	F8 L25	FDR	.01	1.08	4.44	.30
810	F8 L23	817	F8 22	FDR	.13	75.18	310.16	21.06
815	F8 L25	810	F8 L23	FDR	.01	1.08	4.44	.30
817	F8 22	810	F8 L23	FDR	.13	75.18	309.74	21.06
817	F8 22	820	F8 30 UF1	FDR	.63	64.10	264.08	17.96
820	F8 30 UF1	817	F8 22	FDR	.63	64.10	262.41	17.96
820	F8 30 UF1	825	8-22 PRI	FDR	.53	35.18	144.03	9.86
825	8-22 PRI	820	F8 30 UF1	FDR	.53	35.18	143.25	9.86
900	FDR 9	90	SWGR O	FDR	.04	109.31	462.29	47.53
900	FDR 9	905	STEP SEC	TX2	.67	109.31	462.29	UNKNOW
905	STEP SEC	900	FDR 9	TX2	.67	36.44	459.23	UNKNOW
905	STEP SEC	910	F 96	FDR	.07	36.44	459.23	10.21
910	F 96	905	STEP SEC	FDR	.07	36.44	458.94	10.21
910	F 96	915	F910	FDR	.08	34.92	439.82	9.78
915	F910	910	F 96	FDR	.08	34.92	439.46	9.78
915	F910	920	F940	FDR	.40	29.84	375.56	8.36
920	F940	915	F910	FDR	.40	29.84	374.07	8.36
920	F940	945	F949 L1	FDR	.07	28.97	363.14	8.11
925	()	930	RICH SUB	FDR	.04	2.14	26.41	1.53

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
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FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
925	()	935	9-8 PRI	FDR	.04	2.14	26.41	2.04
930	RICH SUB	562	RS SEC	FDR	.00	2.14	26.42	1.53
930	RICH SUB	925	()	FDR	.04	2.14	26.42	1.53
935	9-8 PRI	925	()	FDR	.04	2.14	26.40	2.04
935	9-8 PRI	940	9-9 PRI	FDR	.11	1.29	15.84	1.22
940	9-9 PRI	935	9-8 PRI	FDR	.11	1.29	15.82	1.22
945	F949 L1	920	F940	FDR	.07	28.97	362.89	8.11
945	F949 L1	950	9-12 PRI	FDR	.02	.70	8.73	.66
945	F949 L1	960	9-13 PRI	FDR	.45	27.82	348.48	15.12
950	9-12 PRI	945	F949 L1	FDR	.02	.70	8.72	.66
950	9-12 PRI	955	9-11 PRI	FDR	.01	.35	4.36	.33
955	9-11 PRI	950	9-12 PRI	FDR	.01	.35	4.36	.33
960	9-13 PRI	945	F949 L1	FDR	.45	27.82	346.93	15.12
960	9-13 PRI	963	9-14 PRI	FDR	1.46	26.32	328.18	14.30
963	9-14 PRI	960	9-13 PRI	FDR	1.46	26.32	323.39	14.30
963	9-14 PRI	966	9-15 PRI	FDR	.40	24.84	305.19	13.50
966	9-15 PRI	963	9-14 PRI	FDR	.40	24.84	303.95	13.50
966	9-15 PRI	969	SW UP	FDR	.11	24.66	301.86	13.40
969	SW UP	966	9-15 PRI	FDR	.11	24.66	301.53	13.40
969	SW UP	972	SW DOWN	FDR	.00	24.66	301.53	5.30
972	SW DOWN	969	SW UP	FDR	.00	24.66	301.53	5.30
972	SW DOWN	975	9-16 PRI	FDR	1.51	24.66	301.53	13.40
975	9-16 PRI	972	SW DOWN	FDR	1.51	24.66	296.88	13.40
975	9-16 PRI	977	9-19 PRI	FDR	.10	1.34	16.12	.73
975	9-16 PRI	980		FDR	.60	23.33	280.76	12.68
977	9-19 PRI	975	9-16 PRI	FDR	.10	1.34	16.10	.73
980		975	9-16 PRI	FDR	.60	23.33	279.03	12.68
980		982	9-20 PRI	FDR	.01	.50	5.98	.27
980		983	9-25 PRI	FDR	1.00	22.83	273.05	12.41
982	9-20 PRI	980		FDR	.01	.50	5.98	.27
983	9-25 PRI	980		FDR	1.00	22.83	270.20	12.41
983	9-25 PRI	984	9-25 SEC	TX2	.00	.00	.00	UNKNOW
983	9-25 PRI	985	9-34 PRI	FDR	.14	9.80	115.98	5.32
984	9-25 SEC	983	9-25 PRI	TX2	.00	.00	.00	UNKNOW
985	9-34 PRI	983	9-25 PRI	FDR	.14	9.80	115.81	5.32
985	9-34 PRI	987		FDR	.42	8.94	105.70	4.86
987		985	9-34 PRI	FDR	.42	8.94	105.23	4.86
987		990	9-26 PRI	FDR	.26	3.67	43.16	1.99
987		992		FDR	1.04	5.27	62.07	2.87
990	9-26 PRI	987		FDR	.26	3.67	43.04	1.99

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
992		987		FDR	1.04	5.27	61.39	2.87
992		995	9-30 PRI	FDR	.73	3.62	42.12	3.02
992		997	9-32 PRI	FDR	.06	1.66	19.27	.90
995	9-30 PRI	992		FDR	.73	3.62	41.79	3.02
997	9-32 PRI	992		FDR	.06	1.66	19.25	.90

NOTE: FOR FEEDERS, RATING% = LOAD FLOW AMPS / FLA.
FLA = LIBRARY FLA EXCLUDING DUCT BANK AND TEMP. DERATING FOR CABLES.
FLA = BRANCH RECORD INPUT FLA FOR IMPEDANCE DATA.

NOTE: FOR TRANSFORMERS, RATING% = LOAD FLOW KVA / TRANSFORMER FULL LOAD KVA.

127 BUSES

*** T O T A L   S Y S T E M   L O S S E S ***
76.1 KW   239.2 KVAR

WARNING STUDY CONTAINS   8 VOLTAGE CRITERIA VIOLATIONS
VIOLATIONS DENOTED BY ($) AT BUS AND BRANCH %VD LOCATIONS

APPENDIX G

Load Flow Analysis - Case 2

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

DATE: 20 NOV 95
TIME: 4 52 PM

ALL INFORMATION PRESENTED IS FOR REVIEW, APPROVAL
INTERPRETATION AND APPLICATION BY A REGISTERED
ENGINEER ONLY

DAPPER (LOAD FLOW AND VOLTAGE DROP MINI/MICRO VERSION 4.5 LEVEL 1.0)

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

SWING GENERATORS

BUS NO	ID	STAT	VOLTAGE	ANGLE
80	6	1	1.000	.000

PV GENERATORS

BUS NO	ID	STAT	VOLTAGE	kW	kVARMIN	kVARMAX	PARTICIPATION
10	1	1	1.000	1000.	0.	0.	1.000
20	2	1	1.000	0.	0.	0.	1.000
30	3	1	1.000	0.	0.	0.	1.000
40	4	1	1.000	0.	0.	0.	1.000
50	5	1	1.000	0.	0.	0.	1.000

NOTICE: BRANCH 920 F940 TO 925 () IS OUT OF SERVICE

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE	DUCT	INSUL
10 GEN G1	15 G1 STEP-UP	1	2400.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
20 GEN G2	25 G2 STEP-UP	1	2400.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
30 GEN G3	35 G3 STEP-UP	1	2400.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
40 GEN G4	70 SWGR N	1	4160.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
50 GEN G5	70 SWGR N	1	4160.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
60 SWGR S	66 SM1A BLUE	1	4160.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
60 SWGR S	70 SWGR N	1	4160.	5. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
60 SWGR S	100 FDR 1	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET					STATUS: EXISTING		
60 SWGR S	200 FDR 2	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET					STATUS: EXISTING		
60 SWGR S	300 FDR 3	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET					STATUS: EXISTING		
60 SWGR S	400 FDR 4	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET					STATUS: EXISTING		
60 SWGR S	500 FDR 5	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET					STATUS: EXISTING		
62 SS-1 SEC	64 MCC 4&5	1	480.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
64 MCC 4&5	68 BLUE SSS	1	480.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
70 SWGR N	90 SWGR O	1	4160.	10. FT	500	A	M	XLP
IMPEDANCE:	.0453 + J .0444 OHMS/M FEET					STATUS: EXISTING		

F E E D E R D A T A

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE	DUCT	INSUL
85 T1 SEC	90 SWGR O	1	4160.	10. FT	500	A	M	XLP
IMPEDANCE:	.0453 + J .0444 OHMS/M FEET					STATUS: EXISTING		
90 SWGR O	600 O/H BUS	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET					STATUS: EXISTING		
90 SWGR O	700 FDR 7	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET					STATUS: EXISTING		
90 SWGR O	800 FDR 8	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET					STATUS: EXISTING		
90 SWGR O	900 FDR 9	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET					STATUS: EXISTING		
100 FDR 1	105 F1F12 14	1	4160.	1500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
105 F1F12 14	110 F1 L14	1	4160.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
110 F1 L14	115 F1 L15	1	4160.	300. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
110 F1 L14	120 F1 L31	1	4160.	400. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
120 F1 L31	121 F1 L63	1	4160.	450. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
121 F1 L63	122 F1 L64	1	4160.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
121 F1 L63	125 F1 L67	1	4160.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
125 F1 L67	130 F1 L613	1	4160.	700. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
125 F1 L67	135 F1 L68	1	4160.	300. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
200 FDR 2	205	1	4160.	600. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		

F E E D E R   D A T A

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER DESCRIPTION SIZE	TYPE	DUCT	INSUL
205	210 2-3 PRI	1	4160.	150. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
205	235 F5 F29	1	4160.	400. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
210 2-3 PRI	215 2-4 PRI	1	4160.	50. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
215 2-4 PRI	220 2-5 PRI	1	4160.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
235 F5 F29	236 F2 F211	1	4160.	250. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
236 F2 F211	240 F1 F213	1	4160.	250. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
300 FDR 3	301 F8 F311	1	4160.	400. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
301 F8 F311	303 F713	1	4160.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
303 F713	305 F8 F311	1	4160.	400. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
305 F8 F311	310 F3 19	1	4160.	1200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
400 FDR 4	401 4-1 PRI	1	4160.	250. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
401 4-1 PRI	403 F1 F45	1	4160.	250. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
403 F1 F45	405 F4 10	1	4160.	500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
405 F4 10	410 F417 UF1	1	4160.	1000. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
500 FDR 5	505 F4 F5 F6UF	1	4160.	625. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

F E E D E R D A T A

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER DESCRIPTION SIZE	TYPE	DUCT	INSUL
505 F4 F5 F6UF	510 5-1 PRI	1	4160.	250. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
505 F4 F5 F6UF	512 5-3 PRI	1	4160.	1600. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
512 5-3 PRI	514 5-5 PRI	1	4160.	700. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
512 5-3 PRI	515 F5 L24	1	4160.	1200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
515 F5 L24	520 5-6 PRI	1	4160.	600. FT	6	A	B	OH-2
IMPEDANCE:	.6900 + J .1440 OHMS/M FEET				STATUS: EXISTING			
515 F5 L24	525 F5 L31	1	4160.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
525 F5 L31	530 F5 L39	1	4160.	1500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
525 F5 L31	531 F3 L41	1	4160.	500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
525 F5 L31	535 F537 L5	1	4160.	1400. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
531 F3 L41	535 F537 L5	1	4160.	900. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
535 F537 L5	540 F5 L5 UF1	1	4160.	150. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
535 F537 L5	555	1	4160.	800. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET				STATUS: EXISTING			
540 F5 L5 UF1	545 F5 L56 UF1	1	4160.	2100. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET				STATUS: EXISTING			
540 F5 L5 UF1	550 F5 L55	1	4160.	1000. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
555	560 RICH SUB	1	4160.	3200. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET				STATUS: EXISTING			

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	TYPE	DESCRIPTION DUCT	INSUL
555	565 5-17 PRI	1	4160.	800. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET				STATUS: EXISTING			
562 RS SEC	930 RICH SUB	1	13200.	5. FT	4	A	B	OH-3
IMPEDANCE:	.4360 + J .1380 OHMS/M FEET				STATUS: EXISTING			
565 5-17 PRI	570 5-18 PRI	1	4160.	400. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET				STATUS: EXISTING			
565 5-17 PRI	575 F5 51	1	4160.	300. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET				STATUS: EXISTING			
575 F5 51	580 F5 L85	1	4160.	600. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET				STATUS: EXISTING			
580 F5 L85	585 F5 L87 UF1	1	4160.	350. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET				STATUS: EXISTING			
580 F5 L85	590 F5 L8911	1	4160.	250. FT	4	A	B	OH-2
IMPEDANCE:	.4360 + J .1380 OHMS/M FEET				STATUS: EXISTING			
590 F5 L8911	595 F5 L8 25	1	4160.	1150. FT	4	A	B	OH-2
IMPEDANCE:	.4360 + J .1380 OHMS/M FEET				STATUS: EXISTING			
700 FDR 7	705 WELL9 POL	1	4160.	50. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
705 WELL9 POL	709 F9 F73	1	4160.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
709 F9 F73	710 F7 L11	1	4160.	1000. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
710 F7 L11	715 F7 L13	1	4160.	500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
710 F7 L11	720 F713	1	4160.	500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
720 F713	725 7-15 PRI	1	4160.	1200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
725 7-15 PRI	730 F7 L43	1	4160.	600. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

F E E D E R D A T A

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	TYPE	DESCRIPTION DUCT	INSUL
725 7-15 PRI	735 F7 L54	1	4160.	350. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
735 F7 L54	740 7-17 PRI	1	4160.	700. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
735 F7 L54	745	1	4160.	625. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
745	750 F7 L72	1	4160.	525. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
745	760 7-21 PRI	1	4160.	1400. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
750 F7 L72	755 F7-33	1	4160.	800. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
760 7-21 PRI	765 7-22 PRI	1	4160.	600. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
765 7-22 PRI	770 7-23 PRI	1	4160.	700. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
770 7-23 PRI	775 7-24 PRI	1	4160.	700. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
800 FDR 8	805 F8 L11	1	4160.	1800. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
805 F8 L11	810 F8 L23	1	4160.	1000. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
810 F8 L23	815 F8 L25	1	4160.	700. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
810 F8 L23	817 F8 22	1	4160.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
817 F8 22	820 F8 30 UF1	1	4160.	1100. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
820 F8 30 UF1	825 8-22 PRI	1	4160.	1700. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE	DUCT	INSUL
905 STEP SEC	910 F 96	1	13200.	600. FT	4/0	A	B	OH-3
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
910 F 96	915 F910	1	13200.	800. FT	4/0	A	B	OH-3
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
915 F910	920 F940	1	13200.	4500. FT	4/0	A	B	OH-3
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
920 F940	945 F949 L1	1	13200.	800. FT	4/0	A	B	OH-3
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
925 ()	930 RICH SUB	1	13200.	1500. FT	4	A	B	OH-3
IMPEDANCE:	.4360 + J .1380 OHMS/M FEET					STATUS: EXISTING		
925 ()	935 9-8 PRI	1	13200.	1000. FT	6	A	B	OH-3
IMPEDANCE:	.6900 + J .1440 OHMS/M FEET					STATUS: EXISTING		
935 9-8 PRI	940 9-9 PRI	1	13200.	5000. FT	6	A	B	OH-3
IMPEDANCE:	.6900 + J .1440 OHMS/M FEET					STATUS: EXISTING		
945 F949 L1	950 9-12 PRI	1	13200.	2100. FT	6	A	B	OH-3
IMPEDANCE:	.6900 + J .1440 OHMS/M FEET					STATUS: EXISTING		
945 F949 L1	960 9-13 PRI	1	13200.	2200. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
950 9-12 PRI	955 9-11 PRI	1	13200.	1800. FT	6	A	B	OH-3
IMPEDANCE:	.6900 + J .1440 OHMS/M FEET					STATUS: EXISTING		
960 9-13 PRI	963 9-14 PRI	1	13200.	7600. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
963 9-14 PRI	966 9-15 PRI	1	13200.	2200. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
966 9-15 PRI	969 SW UP	1	13200.	600. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
969 SW UP	972 SW DOWN	1	13200.	5. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
972 SW DOWN	975 9-16 PRI	1	13200.	8400. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER DESCRIPTION SIZE	TYPE	DUCT	INSUL
975 9-16 PRI	977 9-19 PRI	1	13200.	10000. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
975 9-16 PRI	980	1	13200.	3500. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
980	982 9-20 PRI	1	13200.	2000. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
980	983 9-25 PRI	1	13200.	6000. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
983 9-25 PRI	985 9-34 PRI	1	13200.	2000. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
985 9-34 PRI	987	1	13200.	6400. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
987	990 9-26 PRI	1	13200.	9800. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
987	992	1	13200.	27000. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
992	995 9-30 PRI	1	13200.	25000. FT	2	A	N	XLP
IMPEDANCE:	.3350 + J .0500 OHMS/M FEET					STATUS: EXISTING		
992	997 9-32 PRI	1	13200.	5000. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

T R A N S F O R M E R D A T A

PRIMARY RECORD NO NAME	VOLTS L-L	PRI FLA	* SECONDARY RECORD NO NAME	VOLTS L-L	SEC FLA	NOMINAL KVA
15 G1 STEP-UP	2400.	361.	60 SWGR S	4160.	208.	1500.0
IMPEDANCE:	1.0000 + J 5.6623 PERCENT					
25 G2 STEP-UP	2400.	361.	60 SWGR S	4160.	208.	1500.0
IMPEDANCE:	1.0000 + J 5.6623 PERCENT					
35 G3 STEP-UP	2400.	361.	60 SWGR S	4160.	208.	1500.0
IMPEDANCE:	1.0000 + J 5.6623 PERCENT					
60 SWGR S	4160.	42.	62 SS-1 SEC	480.	361.	300.0
IMPEDANCE:	.7816 + J 4.5331 PERCENT					
66 SM1A BLUE	4160.	69.	68 BLUE SSS	480.	601.	500.0
IMPEDANCE:	.8156 + J 4.7302 PERCENT					
80 UTILITY	24900.	58.	85 T1 SEC	4160.	347.	2500.0
IMPEDANCE:	.5546 + J 5.9341 PERCENT		TRANSFORMER FIXED TAP:			-5.0 %
90 SWGR O	4160.	42.	64 MCC 4&5	480.	361.	300.0
IMPEDANCE:	.5709 + J 3.3111 PERCENT					
210 2-3 PRI	4160.	31.	225 2-3 SEC	480.	271.	225.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
215 2-4 PRI	4160.	31.	230 2-4 SEC	208.	625.	225.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
410 F417 UF1	4160.	69.	415 4-6 SEC	208.	1388.	500.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
545 F5 L56 UF1	4160.	16.	547 5-16 SEC	208.	312.	112.5
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
560 RICH SUB	4160.	83.	562 RS SEC	13200.	26.	600.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
590 F5 L8911	4160.	7.	591 5-23 SEC	208.	139.	50.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
590 F5 L8911	4160.	16.	593 5-24 SEC	208.	312.	112.5
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
705 WELL9 POL	4160.	21.	707 7-1 SEC	480.	180.	150.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

T R A N S F O R M E R   D A T A

PRIMARY RECORD NO NAME	VOLTS L-L	PRI FLA	* SECONDARY RECORD NO NAME	VOLTS L-L	SEC FLA	NOMINAL KVA
900 FDR 9	4160.	208.	905 STEP SEC	13200.	66.	1500.0
IMPEDANCE:	.7816 + J 4.5331 PERCENT					
983 9-25 PRI	13200.	22.	984 9-25 SEC	208.	1388.	500.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					

B U S   S P E C I A L   S T U D Y   D A T A

* NO *	NAME *	KW *	KVAR *	LOAD TYPE
105	F1F12 14	9.	3.	CONSTANT Z LOAD
110	F1 L14	21.	7.	CONSTANT Z LOAD
115	F1 L15	25.	8.	CONSTANT Z LOAD
120	F1 L31	222.	73.	CONSTANT Z LOAD
121	F1 L63	62.	21.	CONSTANT Z LOAD
122	F1 L64	98.	32.	CONSTANT Z LOAD
125	F1 L67	62.	20.	CONSTANT Z LOAD
130	F1 L613	31.	10.	CONSTANT Z LOAD
135	F1 L68	14.	5.	CONSTANT Z LOAD
205		69.	22.	CONSTANT Z LOAD
210	2-3 PRI	88.	29.	CONSTANT Z LOAD
215	2-4 PRI	88.	29.	CONSTANT Z LOAD
220	2-5 PRI	58.	19.	CONSTANT Z LOAD
235	F5 F29	44.	14.	CONSTANT Z LOAD
236	F2 F211	88.	29.	CONSTANT Z LOAD
240	F1 F213	88.	29.	CONSTANT Z LOAD
301	F8 F311	186.	61.	CONSTANT Z LOAD
305	F8 F311	15.	5.	CONSTANT Z LOAD
310	F3 19	162.	54.	CONSTANT Z LOAD
401	4-1 PRI	75.	25.	CONSTANT Z LOAD
403	F1 F45	125.	41.	CONSTANT KVA LOAD
405	F4 10	65.	22.	CONSTANT Z LOAD
410	F417 UF1	143.	47.	CONSTANT Z LOAD
510	5-1 PRI	31.	10.	CONSTANT Z LOAD
512	5-3 PRI	14.	5.	CONSTANT Z LOAD
514	5-5 PRI	5.	2.	CONSTANT Z LOAD
515	F5 L24	8.	3.	CONSTANT Z LOAD
520	5-6 PRI	5.	2.	CONSTANT Z LOAD
525	F5 L31	8.	3.	CONSTANT Z LOAD
530	F5 L39	5.	2.	CONSTANT Z LOAD
531	F3 L41	16.	5.	CONSTANT Z LOAD
535	F537 L5	5.	2.	CONSTANT Z LOAD
540	F5 L5 UF1	2.	1.	CONSTANT Z LOAD
545	F5 L56 UF1	12.	4.	CONSTANT Z LOAD
550	F5 L55	2.	1.	CONSTANT Z LOAD
565	5-17 PRI	5.	2.	CONSTANT Z LOAD
570	5-18 PRI	8.	3.	CONSTANT Z LOAD
575	F5 51	2.	1.	CONSTANT Z LOAD

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

B U S S P E C I A L S T U D Y D A T A

NO	NAME	KW	KVAR	LOAD TYPE
580	F5 L85	8.	3.	CONSTANT Z LOAD
585	F5 L87 UF1	24.	8.	CONSTANT Z LOAD
590	F5 L8911	41.	11.	CONSTANT Z LOAD
595	F5 L8 25	33.	10.	CONSTANT Z LOAD
705	WELL9 POL	41.	14.	CONSTANT Z LOAD
709	F9 F73	83.	27.	CONSTANT Z LOAD
710	F7 L11	84.	28.	CONSTANT Z LOAD
715	F7 L13	21.	7.	CONSTANT Z LOAD
720	F713	31.	10.	CONSTANT Z LOAD
725	7-15 PRI	92.	30.	CONSTANT Z LOAD
730	F7 L43	12.	4.	CONSTANT Z LOAD
735	F7 L54	21.	7.	CONSTANT Z LOAD
740	7-17 PRI	17.	5.	CONSTANT Z LOAD
750	F7 L72	21.	7.	CONSTANT Z LOAD
755	F7-33	7.	2.	CONSTANT Z LOAD
760	7-21 PRI	12.	4.	CONSTANT Z LOAD
765	7-22 PRI	21.	7.	CONSTANT Z LOAD
770	7-23 PRI	5.	2.	CONSTANT Z LOAD
775	7-24 PRI	12.	4.	CONSTANT Z LOAD
805	F8 L11	30.	10.	CONSTANT Z LOAD
810	F8 L23	73.	24.	CONSTANT Z LOAD
815	F8 L25	4.	1.	CONSTANT Z LOAD
817	F8 22	44.	15.	CONSTANT Z LOAD
820	F8 30 UF1	116.	38.	CONSTANT Z LOAD
825	8-22 PRI	136.	45.	CONSTANT KVA LOAD
910	F 96	18.	6.	CONSTANT Z LOAD
915	F910	60.	20.	CONSTANT Z LOAD
920	F940	10.	3.	CONSTANT Z LOAD
935	9-8 PRI	10.	3.	CONSTANT Z LOAD
940	9-9 PRI	15.	5.	CONSTANT Z LOAD
945	F949 L1	5.	2.	CONSTANT Z LOAD
950	9-12 PRI	4.	1.	CONSTANT Z LOAD
955	9-11 PRI	4.	1.	CONSTANT Z LOAD
960	9-13 PRI	18.	6.	CONSTANT Z LOAD
963	9-14 PRI	18.	6.	CONSTANT Z LOAD
966	9-15 PRI	2.	1.	CONSTANT Z LOAD
977	9-19 PRI	16.	5.	CONSTANT Z LOAD
982	9-20 PRI	6.	2.	CONSTANT Z LOAD

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
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E M C ENGINEERS, INC. - DENVER, COLORADO

BUS SPECIAL STUDY DATA

* NO *	NAME *	KW *	KVAR *	LOAD TYPE
983	9-25 PRI	163.	53.	CONSTANT Z LOAD
985	9-34 PRI	11.	4.	CONSTANT Z LOAD
990	9-26 PRI	46.	15.	CONSTANT Z LOAD
995	9-30 PRI	46.	15.	CONSTANT Z LOAD
997	9-32 PRI	21.	7.	CONSTANT Z LOAD

*** SOLUTION COMMENTS ***
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SOLUTION PARAMETERS

BRANCH VOLTAGE CRITERIA	:	4.00 %
BUS VOLTAGE CRITERIA	:	5.00 %
ACCELERATION FACTOR FOR 'PV' GENERATORS	:	1.00
ACCELERATION FACTOR FOR CONSTANT KVA LOADS	:	1.00
EXACT(ITERATIVE) SOLUTION	:	YES

<<PERCENT VOLTAGE DROPS ARE BASED ON NOMINAL DESIGN VOLTAGES>>

TOF SIZE: 472

LARGEST LOAD:	1000.00 KVA		
CONVERGENCE CRITERIA:	.050 KVA		
LARGEST BUS MISMATCH	10	GEN G1	47.552 KVA
LARGEST BUS MISMATCH	10	GEN G1	2.699 KVA
LARGEST BUS MISMATCH	10	GEN G1	.155 KVA
LARGEST BUS MISMATCH	10	GEN G1	.009 KVA

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (SWING GENERATORS)
****

BUS	VOLTS(PU)	ANGLE	KW	KVAR	VD%	R + JX (PU)
80	1.000	.00	2533.1	1392.9	.0	

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (PV GENERATOR SCHEDULE REPORT)
****

		---VOLTAGE---		-KVAR LIMITS-		---ACTUAL----	
BUS NAME	ID	SCHED.	ACTUAL	MIN	MAX	KW	KVAR
10 GEN G1	1	1.000	1.023	.0	.0	1000.0	.0
20 GEN G2	2	1.000	1.017	.0	.0	.0	.0
30 GEN G3	3	1.000	1.017	.0	.0	.0	.0
40 GEN G4	4	1.000	1.017	.0	.0	.0	.0
50 GEN G5	5	1.000	1.017	.0	.0	.0	.0

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                  BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:   10 GEN G1      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2456 %VD: -2.3
======================== PU BUS VOLTAGE:  1.023        ANGLE:  -1.0 DEGREES
            ** PV TYPE GENERATOR:   1    1000.0 KW       .0 KVAR

LOAD    TO:   15 G1 STEP-UP   FEEDER AMPS:   235 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:   1000.0 KW       .0 KVAR   1000.0 KVA  PF:1.00 UNITY
LOSSES THRU FEEDER:         .2 KW       .4 KVAR       .5 KVA


==== BUS:   15 G1 STEP-UP DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2455 %VD: -2.3
======================== PU BUS VOLTAGE:  1.023        ANGLE:  -1.0 DEGREES

LOAD FROM:   10 GEN G1        FEEDER AMPS:   235 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     999.8 KW      -.4 KVAR    999.8 KVA  PF:1.00 UNITY
LOSSES THRU FEEDER:          .2 KW       .4 KVAR       .5 KVA

LOAD    TO:   60 SWGR S       TRANSF AMPS:   235 VOLTAGE DROP:   14. %VD:   .6
PROJECTED POWER FLOW:     999.8 KW      -.4 KVAR    999.8 KVA  PF:1.00 UNITY
LOSSES THRU TRANSF:      6.4 KW    36.1 KVAR    36.6 KVA


==== BUS:   20 GEN G2      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2441 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017        ANGLE:  -3.1 DEGREES
            ** PV TYPE GENERATOR:   2        .0 KW       .0 KVAR
**** NO LOAD SPECIFIED ****


==== BUS:   25 G2 STEP-UP DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2441 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017        ANGLE:  -3.1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:   30 GEN G3      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2441 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017        ANGLE:  -3.1 DEGREES
            ** PV TYPE GENERATOR:   3        .0 KW       .0 KVAR
**** NO LOAD SPECIFIED ****
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:   35 G3 STEP-UP DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2441 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017       ANGLE:  -3.1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:   40 GEN G4     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4231 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017       ANGLE:  -3.1 DEGREES
            ** PV TYPE GENERATOR:    4        .0 KW       .0 KVAR
**** NO LOAD SPECIFIED ****


==== BUS:   50 GEN G5     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4231 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017       ANGLE:  -3.1 DEGREES
            ** PV TYPE GENERATOR:    5        .0 KW       .0 KVAR
**** NO LOAD SPECIFIED ****


==== BUS:   60 SWGR S     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4231 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017       ANGLE:  -3.1 DEGREES

LOAD FROM:   15 G1 STEP-UP   TRANSF AMPS:   136 VOLTAGE DROP:   24. %VD:   .6
PROJECTED POWER FLOW:     993.4 KW    -36.5 KVAR    994.1 KVA  PF:1.00 UNITY
LOSSES THRU TRANSF:      6.4 KW     36.1 KVAR    36.6 KVA

LOAD FROM:   25 G2 STEP-UP   TRANSF AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .0 KW        .0 KVAR       .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:       .0 KW      .0 KVAR      .0 KVA

LOAD FROM:   35 G3 STEP-UP   TRANSF AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .0 KW        .0 KVAR       .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:       .0 KW      .0 KVAR      .0 KVA

LOAD FROM:   62 SS-1 SEC     TRANSF AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .1 KW        .1 KVAR       .2 KVA  PF: .45 LAGGING
LOSSES THRU TRANSF:       .0 KW      .0 KVAR      .0 KVA

LOAD FROM:   66 SM1A BLUE    FEEDER AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .1 KW        .2 KVAR       .3 KVA  PF: .46 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA

LOAD FROM:   70 SWGR N       FEEDER AMPS:   189 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:    1159.6 KW     753.7 KVAR   1383.0 KVA  PF: .84 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD    TO:  100 FDR 1          FEEDER AMPS:    80 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:    556.5 KW    186.4 KVAR    586.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .0 KVAR       .1 KVA

LOAD    TO:  200 FDR 2          FEEDER AMPS:    77 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:    539.1 KW    177.5 KVAR    567.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .0 KVAR       .1 KVA

LOAD    TO:  300 FDR 3          FEEDER AMPS:    54 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:    374.5 KW    124.4 KVAR    394.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD    TO:  400 FDR 4          FEEDER AMPS:    60 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:    417.1 KW    138.7 KVAR    439.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .0 KVAR       .1 KVA

LOAD    TO:  500 FDR 5          FEEDER AMPS:    38 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:    266.0 KW     90.6 KVAR    281.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

==== BUS:   62 SS-1 SEC   DESIGN VOLTAGE:   480  BUS VOLTAGE:   488 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017         ANGLE:  -3.1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:   64 MCC 4&5    DESIGN VOLTAGE:   480  BUS VOLTAGE:   488 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017         ANGLE:  -3.1 DEGREES

LOAD    TO:   62 SS-1 SEC     FEEDER AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .1 KW       .1 KVAR       .2 KVA  PF: .45 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD    TO:   68 BLUE SSS     FEEDER AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .1 KW       .2 KVAR       .3 KVA  PF: .46 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD FROM:   90 SWGR O       TRANSF AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .2 KW       .4 KVAR       .4 KVA  PF: .45 LAGGING
LOSSES THRU TRANSF:     .0 KW      .0 KVAR      .0 KVA
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               BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:   66 SM1A BLUE  DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4231 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017       ANGLE:  -3.1 DEGREES

LOAD   TO:   60 SWGR S       FEEDER AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .1 KW       .2 KVAR         .3 KVA  PF: .46 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR         .0 KVA

LOAD FROM:   68 BLUE SSS     TRANSF AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .1 KW       .2 KVAR         .3 KVA  PF: .46 LAGGING
LOSSES THRU TRANSF:      .0 KW      .0 KVAR       .0 KVA


==== BUS:   68 BLUE SSS   DESIGN VOLTAGE:   480  BUS VOLTAGE:   488 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017       ANGLE:  -3.1 DEGREES

LOAD FROM:   64 MCC 4&5      FEEDER AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .1 KW       .2 KVAR         .3 KVA  PF: .46 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR         .0 KVA

LOAD   TO:   66 SM1A BLUE    TRANSF AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .1 KW       .2 KVAR         .3 KVA  PF: .46 LAGGING
LOSSES THRU TRANSF:      .0 KW      .0 KVAR       .0 KVA


==== BUS:   70 SWGR N     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4231 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017       ANGLE:  -3.1 DEGREES

LOAD FROM:   40 GEN G4       FEEDER AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .0 KW       .0 KVAR         .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR         .0 KVA

LOAD FROM:   50 GEN G5       FEEDER AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .0 KW       .0 KVAR         .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR         .0 KVA

LOAD   TO:   60 SWGR S       FEEDER AMPS:    189 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:    1159.6 KW    753.7 KVAR     1383.0 KVA  PF: .84 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR         .0 KVA

LOAD FROM:   90 SWGR O       FEEDER AMPS:    189 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:    1159.6 KW    753.7 KVAR     1383.0 KVA  PF: .84 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR         .1 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                 BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:   80 UTILITY    DESIGN VOLTAGE: 24900  BUS VOLTAGE: 24900 %VD:    .0
======================== PU BUS VOLTAGE:  1.000        ANGLE:     .0 DEGREES
               *** SWING  GENERATOR:    6       2533.1 KW      1392.9 KVAR

LOAD   TO:   85 T1 SEC        TRANSF AMPS:    67 VOLTAGE DROP: -431. %VD: -1.7
PROJECTED POWER FLOW:   2533.1 KW   1392.9 KVAR   2890.8 KVA  PF: .88 LAGGING
LOSSES THRU TRANSF:     16.7 KW    179.0 KVAR    179.8 KVA **XFMR TAPS  -5.0%**


==== BUS:   85 T1 SEC     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4232 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017        ANGLE:  -3.1 DEGREES

LOAD FROM:   80 UTILITY       TRANSF AMPS:   381 VOLTAGE DROP:  -72. %VD: -1.7
PROJECTED POWER FLOW:   2516.3 KW   1213.9 KVAR   2793.8 KVA  PF: .90 LAGGING
LOSSES THRU TRANSF:     16.7 KW    179.0 KVAR    179.8 KVA **XFMR TAPS  -5.0%**

LOAD   TO:   90 SWGR O        FEEDER AMPS:   381 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:   2516.3 KW   1213.9 KVAR   2793.8 KVA  PF: .90 LAGGING
LOSSES THRU FEEDER:         .2 KW        .2 KVAR        .3 KVA


==== BUS:   90 SWGR O     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4232 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017        ANGLE:  -3.1 DEGREES

LOAD   TO:   64 MCC 4&5       TRANSF AMPS:       VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:        .2 KW        .4 KVAR        .4 KVA  PF: .45 LAGGING
LOSSES THRU TRANSF:      .0 KW       .0 KVAR       .0 KVA

LOAD   TO:   70 SWGR N        FEEDER AMPS:   189 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:   1159.7 KW    753.7 KVAR   1383.1 KVA  PF: .84 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .1 KVA

LOAD FROM:   85 T1 SEC        FEEDER AMPS:   381 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:   2516.1 KW   1213.7 KVAR   2793.6 KVA  PF: .90 LAGGING
LOSSES THRU FEEDER:         .2 KW        .2 KVAR        .3 KVA

LOAD   TO:  600 O/H BUS       FEEDER AMPS:       VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:       .0 KW        .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  700 FDR 7         FEEDER AMPS:    71 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:    493.9 KW    164.3 KVAR    520.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW        .0 KVAR        .1 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
********************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD    TO:  800 FDR 8        FEEDER AMPS:    59 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     410.8 KW     139.1 KVAR     433.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .0 KVAR        .1 KVA

LOAD    TO:  900 FDR 9        FEEDER AMPS:    65 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     451.6 KW     156.2 KVAR     477.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .0 KVAR        .1 KVA


==== BUS:  100 FDR 1        DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4231 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017        ANGLE:  -3.1 DEGREES

LOAD FROM:   60 SWGR S        FEEDER AMPS:    80 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     556.4 KW     186.4 KVAR     586.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .0 KVAR        .1 KVA

LOAD    TO:  105 F1F12 14     FEEDER AMPS:    80 VOLTAGE DROP:   26. %VD:   .6
PROJECTED POWER FLOW:     556.4 KW     186.4 KVAR     586.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         2.6 KW       3.5 KVAR       4.3 KVA


==== BUS:  105 F1F12 14     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4205 %VD: -1.1
======================== PU BUS VOLTAGE:  1.011        ANGLE:  -3.3 DEGREES
            PROJECTED SPECIAL BUS LOAD:        9.2 KW         2.6 KVAR

LOAD FROM:  100 FDR 1         FEEDER AMPS:    80 VOLTAGE DROP:   26. %VD:   .6
PROJECTED POWER FLOW:     553.8 KW     182.9 KVAR     583.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         2.6 KW       3.5 KVAR       4.3 KVA

LOAD    TO:  110 F1 L14       FEEDER AMPS:    79 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:     544.6 KW     180.3 KVAR     573.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW        .4 KVAR        .6 KVA


==== BUS:  110 F1 L14       DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4202 %VD: -1.0
======================== PU BUS VOLTAGE:  1.010        ANGLE:  -3.3 DEGREES
            PROJECTED SPECIAL BUS LOAD:       21.4 KW         7.1 KVAR

LOAD FROM:  105 F1F12 14      FEEDER AMPS:    79 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:     544.3 KW     179.9 KVAR     573.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW        .4 KVAR        .6 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD   TO:  115 F1 L15       FEEDER AMPS:     4 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     25.5 KW      8.2 KVAR      26.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  120 F1 L31       FEEDER AMPS:    72 VOLTAGE DROP:    6. %VD:    .1
PROJECTED POWER FLOW:    497.3 KW    164.6 KVAR     523.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .6 KW       .7 KVAR        .9 KVA


==== BUS:  115 F1 L15     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4201 %VD: -1.0
========================= PU BUS VOLTAGE:  1.010        ANGLE:  -3.3 DEGREES
              PROJECTED SPECIAL BUS LOAD:     25.5 KW      8.2 KVAR

LOAD FROM:  110 F1 L14       FEEDER AMPS:     4 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     25.5 KW      8.2 KVAR      26.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA


==== BUS:  120 F1 L31     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4195 %VD:  -.9
========================= PU BUS VOLTAGE:  1.009        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:    225.8 KW     74.2 KVAR

LOAD FROM:  110 F1 L14       FEEDER AMPS:    72 VOLTAGE DROP:    6. %VD:    .1
PROJECTED POWER FLOW:    496.8 KW    163.9 KVAR     523.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .6 KW       .7 KVAR        .9 KVA

LOAD   TO:  121 F1 L63       FEEDER AMPS:    39 VOLTAGE DROP:    4. %VD:    .1
PROJECTED POWER FLOW:    271.0 KW     89.6 KVAR     285.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .2 KW       .2 KVAR        .3 KVA


==== BUS:  121 F1 L63     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4192 %VD:  -.8
========================= PU BUS VOLTAGE:  1.008        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:     62.9 KW     21.3 KVAR

LOAD FROM:  120 F1 L31       FEEDER AMPS:    39 VOLTAGE DROP:    4. %VD:    .1
PROJECTED POWER FLOW:    270.8 KW     89.4 KVAR     285.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .2 KW       .2 KVAR        .3 KVA

LOAD   TO:  122 F1 L64       FEEDER AMPS:    14 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     99.2 KW     32.5 KVAR     104.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA
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            BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD   TO:  125 F1 L67       FEEDER AMPS:    16 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     108.6 KW     35.5 KVAR     114.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA


==== BUS:  122 F1 L64     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4191 %VD:  -.7
========================= PU BUS VOLTAGE:  1.007        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:      99.2 KW      32.5 KVAR

LOAD FROM:  121 F1 L63       FEEDER AMPS:    14 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      99.2 KW     32.5 KVAR     104.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA


==== BUS:  125 F1 L67     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4191 %VD:  -.7
========================= PU BUS VOLTAGE:  1.007        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:      62.9 KW      20.3 KVAR

LOAD FROM:  121 F1 L63       FEEDER AMPS:    16 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     108.6 KW     35.5 KVAR     114.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  130 F1 L613      FEEDER AMPS:     5 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      31.5 KW     10.2 KVAR      33.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  135 F1 L68       FEEDER AMPS:     2 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      14.2 KW      5.1 KVAR      15.1 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA


==== BUS:  130 F1 L613    DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4190 %VD:  -.7
========================= PU BUS VOLTAGE:  1.007        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:      31.5 KW      10.1 KVAR

LOAD FROM:  125 F1 L67       FEEDER AMPS:     5 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      31.5 KW     10.1 KVAR      33.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  135 F1 L68      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4191 %VD:  -.7
======================== PU BUS VOLTAGE:  1.007        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:     14.2 KW      5.1 KVAR

LOAD FROM:  125 F1 L67      FEEDER AMPS:     2 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:      14.2 KW      5.1 KVAR     15.1 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA


==== BUS:  200 FDR 2       DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4231 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017        ANGLE:  -3.1 DEGREES

LOAD FROM:   60 SWGR S      FEEDER AMPS:    77 VOLTAGE DROP:   1. %VD:   .0
PROJECTED POWER FLOW:     539.0 KW    177.4 KVAR    567.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .0 KVAR       .1 KVA

LOAD   TO:  205             FEEDER AMPS:    77 VOLTAGE DROP:  10. %VD:   .2
PROJECTED POWER FLOW:     539.0 KW    177.4 KVAR    567.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         1.0 KW      1.3 KVAR      1.6 KVA


==== BUS:  205             DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4221 %VD: -1.5
======================== PU BUS VOLTAGE:  1.015        ANGLE:  -3.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:     71.0 KW     22.6 KVAR

LOAD FROM:  200 FDR 2       FEEDER AMPS:    77 VOLTAGE DROP:  10. %VD:   .2
PROJECTED POWER FLOW:     538.0 KW    176.1 KVAR    566.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         1.0 KW      1.3 KVAR      1.6 KVA

LOAD   TO:  210 2-3 PRI     FEEDER AMPS:    35 VOLTAGE DROP:   1. %VD:   .0
PROJECTED POWER FLOW:     240.8 KW     79.3 KVAR    253.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .1 KVAR       .1 KVA

LOAD   TO:  235 F5 F29      FEEDER AMPS:    33 VOLTAGE DROP:   3. %VD:   .1
PROJECTED POWER FLOW:     226.2 KW     74.2 KVAR    238.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .2 KVAR       .2 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  210 2-3 PRI    DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4220 %VD: -1.4
========================= PU BUS VOLTAGE:  1.014        ANGLE:  -3.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:     90.5 KW     29.8 KVAR

LOAD FROM:  205              FEEDER AMPS:    35 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:    240.7 KW     79.2 KVAR    253.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .1 KVAR       .1 KVA

LOAD   TO:  215 2-4 PRI      FEEDER AMPS:    22 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:    150.2 KW     49.4 KVAR    158.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD FROM:  225 2-3 SEC      TRANSF AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .0 KW       .0 KVAR       .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:      .0 KW      .0 KVAR      .0 KVA


==== BUS:  215 2-4 PRI    DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4219 %VD: -1.4
========================= PU BUS VOLTAGE:  1.014        ANGLE:  -3.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:     90.5 KW     29.8 KVAR

LOAD FROM:  210 2-3 PRI      FEEDER AMPS:    22 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:    150.2 KW     49.4 KVAR    158.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  220 2-5 PRI      FEEDER AMPS:     9 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     59.7 KW     19.5 KVAR     62.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD FROM:  230 2-4 SEC      TRANSF AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .0 KW       .0 KVAR       .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:      .0 KW      .0 KVAR      .0 KVA


==== BUS:  220 2-5 PRI    DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4219 %VD: -1.4
========================= PU BUS VOLTAGE:  1.014        ANGLE:  -3.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:     59.7 KW     19.5 KVAR

LOAD FROM:  215 2-4 PRI      FEEDER AMPS:     9 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     59.7 KW     19.5 KVAR     62.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  225 2-3 SEC     DESIGN VOLTAGE:   480  BUS VOLTAGE:   487 %VD: -1.4
========================= PU BUS VOLTAGE:  1.014       ANGLE:  -3.2 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  230 2-4 SEC     DESIGN VOLTAGE:   208  BUS VOLTAGE:   211 %VD: -1.4
========================= PU BUS VOLTAGE:  1.014       ANGLE:  -3.2 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  235 F5 F29      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4218 %VD: -1.4
========================= PU BUS VOLTAGE:  1.014       ANGLE:  -3.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:     45.2 KW      14.4 KVAR

LOAD FROM:  205               FEEDER AMPS:     33 VOLTAGE DROP:    3. %VD:    .1
PROJECTED POWER FLOW:    226.1 KW     74.0 KVAR    237.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .2 KVAR       .2 KVA

LOAD   TO:  236 F2 F211       FEEDER AMPS:     26 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:    180.8 KW     59.7 KVAR    190.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .1 KVAR       .1 KVA


==== BUS:  236 F2 F211     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4216 %VD: -1.4
========================= PU BUS VOLTAGE:  1.014       ANGLE:  -3.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:     90.4 KW      29.8 KVAR

LOAD FROM:  235 F5 F29        FEEDER AMPS:     26 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:    180.8 KW     59.6 KVAR    190.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .1 KVAR       .1 KVA

LOAD   TO:  240 F1 F213       FEEDER AMPS:     13 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     90.4 KW     29.8 KVAR     95.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  240 F1 F213     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4216 %VD: -1.3
========================= PU BUS VOLTAGE:  1.013       ANGLE:  -3.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:     90.4 KW      29.8 KVAR

LOAD FROM:  236 F2 F211       FEEDER AMPS:     13 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     90.4 KW     29.8 KVAR     95.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
****
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

```
==== BUS:  300 FDR 3         DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4231 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017         ANGLE:  -3.1 DEGREES

LOAD FROM:   60 SWGR S        FEEDER AMPS:    54 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     374.5 KW     124.4 KVAR    394.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA

LOAD   TO:  301 F8 F311       FEEDER AMPS:    54 VOLTAGE DROP:    5. %VD:   .1
PROJECTED POWER FLOW:     374.5 KW     124.4 KVAR    394.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW        .4 KVAR       .5 KVA

==== BUS:  301 F8 F311       DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4226 %VD: -1.6
======================== PU BUS VOLTAGE:  1.016         ANGLE:  -3.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:     192.0 KW      63.0 KVAR

LOAD FROM:  300 FDR 3         FEEDER AMPS:    54 VOLTAGE DROP:    5. %VD:   .1
PROJECTED POWER FLOW:     374.2 KW     124.0 KVAR    394.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW        .4 KVAR       .5 KVA

LOAD   TO:  303 F713          FEEDER AMPS:    26 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     182.2 KW      61.0 KVAR    192.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .1 KVA

==== BUS:  303 F713          DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4225 %VD: -1.6
======================== PU BUS VOLTAGE:  1.016         ANGLE:  -3.1 DEGREES

LOAD FROM:  301 F8 F311       FEEDER AMPS:    26 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     182.2 KW      61.0 KVAR    192.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .1 KVA

LOAD   TO:  305 F8 F311       FEEDER AMPS:    26 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     182.2 KW      61.0 KVAR    192.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR       .1 KVA
```

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                    BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*********************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  305 F8 F311    DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4223 %VD: -1.5
======================== PU BUS VOLTAGE:  1.015        ANGLE:  -3.1 DEGREES
               PROJECTED SPECIAL BUS LOAD:      15.5 KW       5.2 KVAR

LOAD FROM:  303 F713        FEEDER AMPS:   26 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     182.1 KW     60.9 KVAR     192.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .1 KVAR        .1 KVA

LOAD   TO:  310 F3 19       FEEDER AMPS:   24 VOLTAGE DROP:    6. %VD:   .1
PROJECTED POWER FLOW:     166.6 KW     55.7 KVAR     175.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW       .2 KVAR        .3 KVA


==== BUS:  310 F3 19      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4217 %VD: -1.4
======================== PU BUS VOLTAGE:  1.014        ANGLE:  -3.2 DEGREES
               PROJECTED SPECIAL BUS LOAD:     166.4 KW      55.5 KVAR

LOAD FROM:  305 F8 F311     FEEDER AMPS:   24 VOLTAGE DROP:    6. %VD:   .1
PROJECTED POWER FLOW:     166.4 KW     55.5 KVAR     175.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW       .2 KVAR        .3 KVA


==== BUS:  400 FDR 4      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4231 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017        ANGLE:  -3.1 DEGREES

LOAD FROM:   60 SWGR S      FEEDER AMPS:   60 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     417.0 KW    138.6 KVAR     439.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .0 KVAR        .1 KVA

LOAD   TO:  401 4-1 PRI     FEEDER AMPS:   60 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:     417.0 KW    138.6 KVAR     439.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW       .3 KVAR        .4 KVA


==== BUS:  401 4-1 PRI    DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4228 %VD: -1.6
======================== PU BUS VOLTAGE:  1.016        ANGLE:  -3.1 DEGREES
               PROJECTED SPECIAL BUS LOAD:      77.5 KW      25.8 KVAR

LOAD FROM:  400 FDR 4       FEEDER AMPS:   60 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:     416.8 KW    138.3 KVAR     439.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW       .3 KVAR        .4 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

               BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD    TO:  403 F1 F45         FEEDER AMPS:    49 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:     339.3 KW     112.5 KVAR     357.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .2 KVAR        .3 KVA


==== BUS:  403 F1 F45      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4225 %VD: -1.6
======================== PU BUS VOLTAGE:  1.016        ANGLE:  -3.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:     125.0 KW      41.0 KVAR

LOAD FROM:  401 4-1 PRI         FEEDER AMPS:    49 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:     339.1 KW     112.3 KVAR     357.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .2 KVAR        .3 KVA

LOAD    TO:  405 F4 10          FEEDER AMPS:    31 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:     214.1 KW      71.3 KVAR     225.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .2 KVAR        .2 KVA


==== BUS:  405 F4 10       DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4222 %VD: -1.5
======================== PU BUS VOLTAGE:  1.015        ANGLE:  -3.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:      66.9 KW      22.7 KVAR

LOAD FROM:  403 F1 F45          FEEDER AMPS:    31 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:     214.0 KW      71.1 KVAR     225.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .2 KVAR        .2 KVA

LOAD    TO:  410 F417 UF1       FEEDER AMPS:    21 VOLTAGE DROP:    5. %VD:   .1
PROJECTED POWER FLOW:     147.1 KW      48.5 KVAR     154.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .2 KVAR        .2 KVA


==== BUS:  410 F417 UF1    DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4217 %VD: -1.4
======================== PU BUS VOLTAGE:  1.014        ANGLE:  -3.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:     147.0 KW      48.3 KVAR

LOAD FROM:  405 F4 10           FEEDER AMPS:    21 VOLTAGE DROP:    5. %VD:   .1
PROJECTED POWER FLOW:     147.0 KW      48.3 KVAR     154.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .2 KVAR        .2 KVA

LOAD    TO:  415 4-6 SEC        TRANSF AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .0 KW        .0 KVAR         .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:       .0 KW      .0 KVAR      .0 KVA
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               BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  415 4-6 SEC     DESIGN VOLTAGE:   208  BUS VOLTAGE:   211 %VD: -1.4
======================== PU BUS VOLTAGE:  1.014       ANGLE:  -3.2 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  500 FDR 5       DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4231 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017       ANGLE:  -3.1 DEGREES

LOAD FROM:   60 SWGR S       FEEDER AMPS:    38 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     266.0 KW      90.6 KVAR     281.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  505 F4 F5 F6UF   FEEDER AMPS:    38 VOLTAGE DROP:    5. %VD:    .1
PROJECTED POWER FLOW:     266.0 KW      90.6 KVAR     281.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .3 KVAR        .4 KVA


==== BUS:  505 F4 F5 F6UF DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4226 %VD: -1.6
======================== PU BUS VOLTAGE:  1.016       ANGLE:  -3.1 DEGREES

LOAD FROM:  500 FDR 5        FEEDER AMPS:    38 VOLTAGE DROP:    5. %VD:    .1
PROJECTED POWER FLOW:     265.8 KW      90.2 KVAR     280.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .3 KVAR        .4 KVA

LOAD   TO:  510 5-1 PRI      FEEDER AMPS:     5 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      32.0 KW      10.3 KVAR      33.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  512 5-3 PRI      FEEDER AMPS:    34 VOLTAGE DROP:   12. %VD:    .3
PROJECTED POWER FLOW:     233.8 KW      79.9 KVAR     247.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .5 KW        .7 KVAR        .8 KVA


==== BUS:  510 5-1 PRI     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4226 %VD: -1.6
======================== PU BUS VOLTAGE:  1.016       ANGLE:  -3.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:     32.0 KW      10.3 KVAR

LOAD FROM:  505 F4 F5 F6UF   FEEDER AMPS:     5 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      32.0 KW      10.3 KVAR      33.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  512 5-3 PRI    DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4214 %VD: -1.3
========================= PU BUS VOLTAGE:  1.013       ANGLE:  -3.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:      14.4 KW      5.1 KVAR

LOAD FROM:  505 F4 F5 F6UF   FEEDER AMPS:    34 VOLTAGE DROP:   12. %VD:   .3
PROJECTED POWER FLOW:     233.3 KW     79.3 KVAR     246.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .5 KW       .7 KVAR        .8 KVA

LOAD   TO:  514 5-5 PRI      FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       5.1 KW      2.1 KVAR       5.5 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  515 F5 L24       FEEDER AMPS:    31 VOLTAGE DROP:    8. %VD:   .2
PROJECTED POWER FLOW:     213.8 KW     72.1 KVAR     225.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW       .4 KVAR        .5 KVA


==== BUS:  514 5-5 PRI    DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4214 %VD: -1.3
========================= PU BUS VOLTAGE:  1.013       ANGLE:  -3.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:       5.1 KW      2.1 KVAR

LOAD FROM:  512 5-3 PRI      FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       5.1 KW      2.1 KVAR       5.5 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA


==== BUS:  515 F5 L24     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4206 %VD: -1.1
========================= PU BUS VOLTAGE:  1.011       ANGLE:  -3.3 DEGREES
              PROJECTED SPECIAL BUS LOAD:       8.2 KW      3.4 KVAR

LOAD FROM:  512 5-3 PRI      FEEDER AMPS:    31 VOLTAGE DROP:    8. %VD:   .2
PROJECTED POWER FLOW:     213.5 KW     71.7 KVAR     225.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW       .4 KVAR        .5 KVA

LOAD   TO:  520 5-6 PRI      FEEDER AMPS:     1 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:       5.1 KW      2.0 KVAR       5.5 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  525 F5 L31       FEEDER AMPS:    29 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     200.2 KW     66.3 KVAR     210.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .1 KVAR        .1 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  520 5-6 PRI    DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4206 %VD: -1.1
======================== PU BUS VOLTAGE:  1.011       ANGLE:  -3.3 DEGREES
              PROJECTED SPECIAL BUS LOAD:      5.1 KW      2.0 KVAR

LOAD FROM:  515 F5 L24       FEEDER AMPS:      1 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:        5.1 KW       2.0 KVAR       5.5 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:           .0 KW        .0 KVAR        .0 KVA


==== BUS:  525 F5 L31     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4205 %VD: -1.1
======================== PU BUS VOLTAGE:  1.011       ANGLE:  -3.3 DEGREES
              PROJECTED SPECIAL BUS LOAD:      8.2 KW      3.4 KVAR

LOAD FROM:  515 F5 L24       FEEDER AMPS:     29 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:      200.2 KW      66.2 KVAR     210.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .0 KW        .1 KVAR        .1 KVA

LOAD   TO:  530 F5 L39       FEEDER AMPS:      1 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:        5.1 KW       1.9 KVAR       5.5 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:           .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  531 F3 L41       FEEDER AMPS:     14 VOLTAGE DROP:    2. %VD:    .0
PROJECTED POWER FLOW:       98.7 KW      32.1 KVAR     103.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  535 F537 L5      FEEDER AMPS:     13 VOLTAGE DROP:    4. %VD:    .1
PROJECTED POWER FLOW:       88.2 KW      28.8 KVAR      92.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .1 KW        .1 KVAR        .1 KVA


==== BUS:  530 F5 L39     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4205 %VD: -1.1
======================== PU BUS VOLTAGE:  1.011       ANGLE:  -3.3 DEGREES
              PROJECTED SPECIAL BUS LOAD:      5.1 KW      1.9 KVAR

LOAD FROM:  525 F5 L31       FEEDER AMPS:      1 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:        5.1 KW       1.9 KVAR       5.5 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:           .0 KW        .0 KVAR        .0 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  531 F3 L41    DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4204 %VD: -1.0
======================== PU BUS VOLTAGE:  1.010       ANGLE:  -3.3 DEGREES
             PROJECTED SPECIAL BUS LOAD:     16.3 KW      5.1 KVAR

LOAD FROM:  525 F5 L31      FEEDER AMPS:    14 VOLTAGE DROP:    2. %VD:   .0
PROJECTED POWER FLOW:     98.7 KW     32.1 KVAR    103.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  535 F537 L5     FEEDER AMPS:    12 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     82.3 KW     27.0 KVAR     86.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .1 KVA


==== BUS:  535 F537 L5   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4201 %VD: -1.0
======================== PU BUS VOLTAGE:  1.010       ANGLE:  -3.3 DEGREES
             PROJECTED SPECIAL BUS LOAD:      5.1 KW      1.9 KVAR

LOAD FROM:  525 F5 L31      FEEDER AMPS:    13 VOLTAGE DROP:    4. %VD:   .1
PROJECTED POWER FLOW:     88.1 KW     28.8 KVAR     92.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR       .1 KVA

LOAD FROM:  531 F3 L41      FEEDER AMPS:    12 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     82.3 KW     26.9 KVAR     86.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .1 KVA

LOAD   TO:  540 F5 L5 UF1   FEEDER AMPS:     2 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     16.3 KW      6.1 KVAR     17.4 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  555             FEEDER AMPS:    21 VOLTAGE DROP:    5. %VD:   .1
PROJECTED POWER FLOW:    149.0 KW     47.6 KVAR    156.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .2 KW       .1 KVAR       .2 KVA


==== BUS:  540 F5 L5 UF1 DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4201 %VD: -1.0
======================== PU BUS VOLTAGE:  1.010       ANGLE:  -3.3 DEGREES
             PROJECTED SPECIAL BUS LOAD:      2.0 KW      1.0 KVAR

LOAD FROM:  535 F537 L5     FEEDER AMPS:     2 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     16.3 KW      6.1 KVAR     17.4 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD   TO:  545 F5 L56 UF1   FEEDER AMPS:      2 VOLTAGE DROP:    2. %VD:   .0
PROJECTED POWER FLOW:     12.2 KW      4.1 KVAR      12.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  550 F5 L55       FEEDER AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      2.0 KW      1.0 KVAR       2.3 KVA  PF: .89 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA


==== BUS:  545 F5 L56 UF1 DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4199 %VD:  -.9
========================= PU BUS VOLTAGE:  1.009        ANGLE:  -3.3 DEGREES
              PROJECTED SPECIAL BUS LOAD:     12.2 KW       4.1 KVAR

LOAD FROM:  540 F5 L5 UF1    FEEDER AMPS:      2 VOLTAGE DROP:    2. %VD:   .0
PROJECTED POWER FLOW:     12.2 KW      4.1 KVAR      12.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD FROM:  547 5-16 SEC     TRANSF AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .0 KW       .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:      .0 KW      .0 KVAR      .0 KVA


==== BUS:  547 5-16 SEC   DESIGN VOLTAGE:   208  BUS VOLTAGE:   210 %VD:  -.9
========================= PU BUS VOLTAGE:  1.009        ANGLE:  -3.3 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  550 F5 L55     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4201 %VD: -1.0
========================= PU BUS VOLTAGE:  1.010        ANGLE:  -3.3 DEGREES
              PROJECTED SPECIAL BUS LOAD:      2.0 KW       1.0 KVAR

LOAD FROM:  540 F5 L5 UF1    FEEDER AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      2.0 KW      1.0 KVAR       2.3 KVA  PF: .89 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA


==== BUS:  555            DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4196 %VD:  -.9
========================= PU BUS VOLTAGE:  1.009        ANGLE:  -3.4 DEGREES

LOAD FROM:  535 F537 L5      FEEDER AMPS:     21 VOLTAGE DROP:    5. %VD:   .1
PROJECTED POWER FLOW:    148.8 KW     47.5 KVAR     156.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .2 KW       .1 KVAR        .2 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

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LOAD    TO: 560 RICH SUB     FEEDER AMPS:     4 VOLTAGE DROP:   4. %VD:   .1
PROJECTED POWER FLOW:     26.1 KW      8.6 KVAR     27.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD    TO: 565 5-17 PRI     FEEDER AMPS:    18 VOLTAGE DROP:   4. %VD:   .1
PROJECTED POWER FLOW:    122.8 KW     38.9 KVAR    128.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR       .1 KVA


==== BUS:  560 RICH SUB   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4192 %VD:  -.8
======================== PU BUS VOLTAGE:  1.008         ANGLE:  -3.4 DEGREES

LOAD FROM:  555              FEEDER AMPS:     4 VOLTAGE DROP:   4. %VD:   .1
PROJECTED POWER FLOW:     26.1 KW      8.6 KVAR     27.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD    TO: 562 RS SEC       TRANSF AMPS:     4 VOLTAGE DROP:   5. %VD:   .1
PROJECTED POWER FLOW:     26.1 KW      8.6 KVAR     27.4 KVA  PF: .95 LAGGING
LOSSES THRU TRANSF:      .0 KW       .1 KVAR       .1 KVA


==== BUS:  562 RS SEC     DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13288 %VD:  -.7
======================== PU BUS VOLTAGE:  1.007         ANGLE:  -3.5 DEGREES

LOAD FROM:  560 RICH SUB     TRANSF AMPS:     1 VOLTAGE DROP:  15. %VD:   .1
PROJECTED POWER FLOW:     26.0 KW      8.6 KVAR     27.4 KVA  PF: .95 LAGGING
LOSSES THRU TRANSF:      .0 KW       .1 KVAR       .1 KVA

LOAD    TO: 930 RICH SUB     FEEDER AMPS:     1 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:     26.0 KW      8.6 KVAR     27.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  565 5-17 PRI   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4192 %VD:  -.8
======================== PU BUS VOLTAGE:  1.008         ANGLE:  -3.4 DEGREES
            PROJECTED SPECIAL BUS LOAD:       5.1 KW       2.0 KVAR

LOAD FROM:  555              FEEDER AMPS:    18 VOLTAGE DROP:   4. %VD:   .1
PROJECTED POWER FLOW:    122.7 KW     38.8 KVAR    128.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR       .1 KVA
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD   TO:  570 5-18 PRI     FEEDER AMPS:     1 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:      8.1 KW      3.3 KVAR      8.8 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  575 F5 51        FEEDER AMPS:    16 VOLTAGE DROP:   1. %VD:   .0
PROJECTED POWER FLOW:    109.5 KW     33.4 KVAR    114.5 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  570 5-18 PRI   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4192 %VD:  -.8
========================= PU BUS VOLTAGE:  1.008        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:      8.1 KW       3.3 KVAR

LOAD FROM:  565 5-17 PRI     FEEDER AMPS:     1 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:      8.1 KW      3.3 KVAR      8.8 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  575 F5 51      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4190 %VD:  -.7
========================= PU BUS VOLTAGE:  1.007        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:      2.0 KW        .7 KVAR

LOAD FROM:  565 5-17 PRI     FEEDER AMPS:    16 VOLTAGE DROP:   1. %VD:   .0
PROJECTED POWER FLOW:    109.4 KW     33.4 KVAR    114.4 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  580 F5 L85       FEEDER AMPS:    15 VOLTAGE DROP:   3. %VD:   .1
PROJECTED POWER FLOW:    107.4 KW     32.7 KVAR    112.3 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR       .1 KVA


==== BUS:  580 F5 L85     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4188 %VD:  -.7
========================= PU BUS VOLTAGE:  1.007        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:      8.1 KW       3.3 KVAR

LOAD FROM:  575 F5 51        FEEDER AMPS:    15 VOLTAGE DROP:   3. %VD:   .1
PROJECTED POWER FLOW:    107.3 KW     32.7 KVAR    112.2 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR       .1 KVA

LOAD   TO:  585 F5 L87 UF1   FEEDER AMPS:     4 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:     24.3 KW      8.1 KVAR     25.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD   TO:  590 F5 L8911     FEEDER AMPS:    11 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     74.9 KW     21.3 KVAR      77.9 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA


==== BUS:  585 F5 L87 UF1 DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4187 %VD:  -.7
======================== PU BUS VOLTAGE:  1.007        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:     24.3 KW      8.1 KVAR

LOAD FROM:  580 F5 L85       FEEDER AMPS:     4 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     24.3 KW      8.1 KVAR      25.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA


==== BUS:  590 F5 L8911   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4186 %VD:  -.6
======================== PU BUS VOLTAGE:  1.006        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:     41.5 KW     11.1 KVAR

LOAD FROM:  580 F5 L85       FEEDER AMPS:    11 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     74.9 KW     21.2 KVAR      77.8 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  591 5-23 SEC     TRANSF AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .0 KW       .0 KVAR        .0 KVA  PF: .00 LAGGING
LOSSES THRU TRANSF:      .0 KW      .0 KVAR       .0 KVA

LOAD FROM:  593 5-24 SEC     TRANSF AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .0 KW       .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:      .0 KW      .0 KVAR       .0 KVA

LOAD   TO:  595 F5 L8 25     FEEDER AMPS:     5 VOLTAGE DROP:    4. %VD:   .1
PROJECTED POWER FLOW:     33.4 KW     10.1 KVAR      34.9 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA


==== BUS:  591 5-23 SEC   DESIGN VOLTAGE:   208  BUS VOLTAGE:   209 %VD:  -.6
======================== PU BUS VOLTAGE:  1.006        ANGLE:  -3.4 DEGREES
**** NO LOAD SPECIFIED ****
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FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  593 5-24 SEC   DESIGN VOLTAGE:   208  BUS VOLTAGE:   209 %VD:  -.6
========================= PU BUS VOLTAGE:  1.006        ANGLE:  -3.4 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  595 F5 L8 25   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4181 %VD:  -.5
========================= PU BUS VOLTAGE:  1.005        ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:     33.3 KW      10.1 KVAR

LOAD FROM:  590 F5 L8911     FEEDER AMPS:      5 VOLTAGE DROP:    4. %VD:   .1
PROJECTED POWER FLOW:      33.3 KW      10.1 KVAR      34.8 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA


==== BUS:  600 O/H BUS    DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4232 %VD: -1.7
========================= PU BUS VOLTAGE:  1.017        ANGLE:  -3.1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  700 FDR 7      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4231 %VD: -1.7
========================= PU BUS VOLTAGE:  1.017        ANGLE:  -3.1 DEGREES

LOAD FROM:   90 SWGR O       FEEDER AMPS:     71 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     493.8 KW     164.2 KVAR     520.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .0 KVAR        .1 KVA

LOAD   TO:  705 WELL9 POL    FEEDER AMPS:     71 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     493.8 KW     164.2 KVAR     520.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR        .1 KVA


==== BUS:  705 WELL9 POL  DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4230 %VD: -1.7
========================= PU BUS VOLTAGE:  1.017        ANGLE:  -3.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:     42.4 KW      14.5 KVAR

LOAD FROM:  700 FDR 7        FEEDER AMPS:     71 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     493.8 KW     164.1 KVAR     520.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR        .1 KVA

LOAD FROM:  707 7-1 SEC      TRANSF AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .0 KW        .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:       .0 KW       .0 KVAR       .0 KVA
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FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD   TO:  709 F9 F73       FEEDER AMPS:    65 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:    451.4 KW    149.7 KVAR    475.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .2 KW       .3 KVAR       .4 KVA


==== BUS:  707 7-1 SEC    DESIGN VOLTAGE:   480  BUS VOLTAGE:   488 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017       ANGLE:  -3.1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  709 F9 F73     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4227 %VD: -1.6
======================== PU BUS VOLTAGE:  1.016       ANGLE:  -3.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:     85.7 KW     27.9 KVAR

LOAD FROM:  705 WELL9 POL    FEEDER AMPS:    65 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:    451.2 KW    149.4 KVAR    475.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .2 KW       .3 KVAR       .4 KVA

LOAD   TO:  710 F7 L11       FEEDER AMPS:    53 VOLTAGE DROP:   11. %VD:   .3
PROJECTED POWER FLOW:    365.4 KW    121.5 KVAR    385.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .7 KW      1.0 KVAR      1.2 KVA


==== BUS:  710 F7 L11     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4216 %VD: -1.3
======================== PU BUS VOLTAGE:  1.013       ANGLE:  -3.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:     86.3 KW     28.8 KVAR

LOAD FROM:  709 F9 F73       FEEDER AMPS:    53 VOLTAGE DROP:   11. %VD:   .3
PROJECTED POWER FLOW:    364.7 KW    120.5 KVAR    384.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .7 KW      1.0 KVAR      1.2 KVA

LOAD   TO:  715 F7 L13       FEEDER AMPS:     3 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     21.6 KW      7.2 KVAR     22.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  720 F713         FEEDER AMPS:    37 VOLTAGE DROP:    4. %VD:   .1
PROJECTED POWER FLOW:    256.8 KW     84.5 KVAR    270.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .2 KW       .2 KVAR       .3 KVA
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FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  715 F7 L13     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4216 %VD: -1.3
======================== PU BUS VOLTAGE:  1.013        ANGLE:  -3.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:     21.6 KW      7.2 KVAR

LOAD FROM:  710 F7 L11       FEEDER AMPS:     3 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      21.6 KW      7.2 KVAR      22.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA


==== BUS:  720 F713       DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4212 %VD: -1.3
======================== PU BUS VOLTAGE:  1.013        ANGLE:  -3.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:     31.8 KW     10.3 KVAR

LOAD FROM:  710 F7 L11       FEEDER AMPS:    37 VOLTAGE DROP:    4. %VD:   .1
PROJECTED POWER FLOW:     256.7 KW     84.3 KVAR     270.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW       .2 KVAR        .3 KVA

LOAD   TO:  725 7-15 PRI     FEEDER AMPS:    32 VOLTAGE DROP:    8. %VD:   .2
PROJECTED POWER FLOW:     224.9 KW     74.0 KVAR     236.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW       .5 KVAR        .6 KVA


==== BUS:  725 7-15 PRI   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4204 %VD: -1.1
======================== PU BUS VOLTAGE:  1.011        ANGLE:  -3.3 DEGREES
              PROJECTED SPECIAL BUS LOAD:     94.0 KW     30.6 KVAR

LOAD FROM:  720 F713         FEEDER AMPS:    32 VOLTAGE DROP:    8. %VD:   .2
PROJECTED POWER FLOW:     224.5 KW     73.6 KVAR     236.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW       .5 KVAR        .6 KVA

LOAD   TO:  730 F7 L43       FEEDER AMPS:     2 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      12.3 KW      4.1 KVAR      12.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  735 F7 L54       FEEDER AMPS:    17 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     118.3 KW     38.8 KVAR     124.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA
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              BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD   TO:  750 F7 L72       FEEDER AMPS:     4 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     28.6 KW       9.2 KVAR      30.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  760 7-21 PRI     FEEDER AMPS:     7 VOLTAGE DROP:    2. %VD:    .1
PROJECTED POWER FLOW:     50.9 KW      17.3 KVAR      53.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  750 F7 L72     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4201 %VD: -1.0
======================== PU BUS VOLTAGE:  1.010        ANGLE:  -3.3 DEGREES
             PROJECTED SPECIAL BUS LOAD:      21.4 KW       7.1 KVAR

LOAD FROM:  745              FEEDER AMPS:     4 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     28.5 KW       9.2 KVAR      30.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  755 F7-33        FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      7.1 KW       2.0 KVAR       7.4 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  755 F7-33      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4200 %VD: -1.0
======================== PU BUS VOLTAGE:  1.010        ANGLE:  -3.3 DEGREES
             PROJECTED SPECIAL BUS LOAD:       7.1 KW       2.0 KVAR

LOAD FROM:  750 F7 L72       FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      7.1 KW       2.0 KVAR       7.4 KVA  PF: .96 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  760 7-21 PRI   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4199 %VD:  -.9
======================== PU BUS VOLTAGE:  1.009        ANGLE:  -3.4 DEGREES
             PROJECTED SPECIAL BUS LOAD:      12.2 KW       4.1 KVAR

LOAD FROM:  745              FEEDER AMPS:     7 VOLTAGE DROP:    2. %VD:    .1
PROJECTED POWER FLOW:     50.9 KW      17.3 KVAR      53.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  765 7-22 PRI     FEEDER AMPS:     6 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     38.7 KW      13.2 KVAR      40.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  765 7-22 PRI   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4198 %VD:  -.9
======================== PU BUS VOLTAGE:  1.009        ANGLE:  -3.4 DEGREES
             PROJECTED SPECIAL BUS LOAD:      21.4 KW      7.1 KVAR

LOAD FROM:  760 7-21 PRI     FEEDER AMPS:     6 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      38.7 KW      13.2 KVAR     40.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA

LOAD    TO:  770 7-23 PRI    FEEDER AMPS:     3 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      17.3 KW       6.1 KVAR     18.4 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA


==== BUS:  770 7-23 PRI   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4198 %VD:  -.9
======================== PU BUS VOLTAGE:  1.009        ANGLE:  -3.4 DEGREES
             PROJECTED SPECIAL BUS LOAD:       5.1 KW      2.0 KVAR

LOAD FROM:  765 7-22 PRI     FEEDER AMPS:     3 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      17.3 KW       6.1 KVAR     18.4 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA

LOAD    TO:  775 7-24 PRI    FEEDER AMPS:     2 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      12.2 KW       4.1 KVAR     12.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA


==== BUS:  775 7-24 PRI   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4198 %VD:  -.9
======================== PU BUS VOLTAGE:  1.009        ANGLE:  -3.4 DEGREES
             PROJECTED SPECIAL BUS LOAD:      12.2 KW      4.1 KVAR

LOAD FROM:  770 7-23 PRI     FEEDER AMPS:     2 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      12.2 KW       4.1 KVAR     12.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA


==== BUS:  800 FDR 8      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4231 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017        ANGLE:  -3.1 DEGREES

LOAD FROM:   90 SWGR O       FEEDER AMPS:    59 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     410.7 KW     139.1 KVAR    433.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .0 KVAR       .1 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

               BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  817 F8 22       DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4195 %VD:  -.8
======================== PU BUS VOLTAGE:  1.008       ANGLE:  -3.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:     44.7 KW      15.3 KVAR

LOAD FROM:  810 F8 L23       FEEDER AMPS:    43 VOLTAGE DROP:    2. %VD:   .0
PROJECTED POWER FLOW:     298.8 KW      99.5 KVAR     314.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR        .2 KVA

LOAD   TO:  820 F8 30 UF1    FEEDER AMPS:    37 VOLTAGE DROP:    9. %VD:   .2
PROJECTED POWER FLOW:     254.0 KW      84.3 KVAR     267.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .4 KW        .5 KVAR        .7 KVA


==== BUS:  820 F8 30 UF1  DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4186 %VD:  -.6
======================== PU BUS VOLTAGE:  1.006       ANGLE:  -3.5 DEGREES
              PROJECTED SPECIAL BUS LOAD:    117.5 KW      38.5 KVAR

LOAD FROM:  817 F8 22        FEEDER AMPS:    37 VOLTAGE DROP:    9. %VD:   .2
PROJECTED POWER FLOW:     253.6 KW      83.7 KVAR     267.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .4 KW        .5 KVAR        .7 KVA

LOAD   TO:  825 8-22 PRI     FEEDER AMPS:    20 VOLTAGE DROP:    7. %VD:   .2
PROJECTED POWER FLOW:     136.2 KW      45.2 KVAR     143.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .2 KVAR        .3 KVA


==== BUS:  825 8-22 PRI   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4179 %VD:  -.5
======================== PU BUS VOLTAGE:  1.005       ANGLE:  -3.5 DEGREES
              PROJECTED SPECIAL BUS LOAD:    136.0 KW      45.0 KVAR

LOAD FROM:  820 F8 30 UF1    FEEDER AMPS:    20 VOLTAGE DROP:    7. %VD:   .2
PROJECTED POWER FLOW:     136.0 KW      45.0 KVAR     143.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .2 KVAR        .3 KVA


==== BUS:  900 FDR 9      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4231 %VD: -1.7
======================== PU BUS VOLTAGE:  1.017       ANGLE:  -3.1 DEGREES

LOAD FROM:    90 SWGR O      FEEDER AMPS:    65 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     451.5 KW     156.2 KVAR     477.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .0 KVAR        .1 KVA
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD   TO:  905 STEP SEC     TRANSF AMPS:    65 VOLTAGE DROP:   29. %VD:   .7
PROJECTED POWER FLOW:     451.5 KW    156.2 KVAR    477.8 KVA  PF: .95 LAGGING
LOSSES THRU TRANSF:      1.1 KW      6.7 KVAR      6.8 KVA


==== BUS:  905 STEP SEC   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13334 %VD: -1.0
======================== PU BUS VOLTAGE:  1.010       ANGLE:  -3.8 DEGREES

LOAD FROM:  900 FDR 9        TRANSF AMPS:    21 VOLTAGE DROP:   91. %VD:   .7
PROJECTED POWER FLOW:     450.4 KW    149.5 KVAR    474.5 KVA  PF: .95 LAGGING
LOSSES THRU TRANSF:      1.1 KW      6.7 KVAR      6.8 KVA

LOAD   TO:  910 F 96         FEEDER AMPS:    21 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:     450.4 KW    149.5 KVAR    474.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR       .1 KVA


==== BUS:  910 F 96       DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13332 %VD: -1.0
======================== PU BUS VOLTAGE:  1.010       ANGLE:  -3.8 DEGREES
             PROJECTED SPECIAL BUS LOAD:      18.2 KW      6.0 KVAR

LOAD FROM:  905 STEP SEC     FEEDER AMPS:    21 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:     450.3 KW    149.4 KVAR    474.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR       .1 KVA

LOAD   TO:  915 F910         FEEDER AMPS:    20 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:     432.1 KW    143.4 KVAR    455.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR       .1 KVA


==== BUS:  915 F910       DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13328 %VD: -1.0
======================== PU BUS VOLTAGE:  1.010       ANGLE:  -3.8 DEGREES
             PROJECTED SPECIAL BUS LOAD:     60.8 KW     20.0 KVAR

LOAD FROM:  910 F 96         FEEDER AMPS:    20 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:     432.0 KW    143.3 KVAR    455.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR       .1 KVA

LOAD   TO:  920 F940         FEEDER AMPS:    17 VOLTAGE DROP:   16. %VD:   .1
PROJECTED POWER FLOW:     371.3 KW    123.4 KVAR    391.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .3 KW       .5 KVAR       .6 KVA
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                 BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  920 F940        DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13312 %VD:  -.8
======================== PU BUS VOLTAGE:  1.008        ANGLE:  -3.8 DEGREES
              PROJECTED SPECIAL BUS LOAD:      10.5 KW       3.4 KVAR

LOAD FROM:  915 F910         FEEDER AMPS:     17 VOLTAGE DROP:   16. %VD:   .1
PROJECTED POWER FLOW:     370.9 KW     122.9 KVAR    390.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW        .5 KVAR       .6 KVA

LOAD    TO:  945 F949 L1     FEEDER AMPS:     16 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:     360.5 KW     119.5 KVAR    379.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR       .1 KVA


==== BUS:  925 ()          DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13286 %VD:  -.7
======================== PU BUS VOLTAGE:  1.007        ANGLE:  -3.5 DEGREES

LOAD FROM:  930 RICH SUB     FEEDER AMPS:      1 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      26.0 KW       8.6 KVAR     27.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA

LOAD    TO:  935 9-8 PRI     FEEDER AMPS:      1 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      26.0 KW       8.6 KVAR     27.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA


==== BUS:  930 RICH SUB    DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13288 %VD:  -.7
======================== PU BUS VOLTAGE:  1.007        ANGLE:  -3.5 DEGREES

LOAD FROM:  562 RS SEC       FEEDER AMPS:      1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      26.0 KW       8.6 KVAR     27.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA

LOAD    TO:  925 ()          FEEDER AMPS:      1 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      26.0 KW       8.6 KVAR     27.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  935 9-8 PRI    DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13285 %VD:  -.6
======================= PU BUS VOLTAGE:  1.006        ANGLE:  -3.5 DEGREES
             PROJECTED SPECIAL BUS LOAD:      10.4 KW       3.4 KVAR

LOAD FROM:  925 ()          FEEDER AMPS:      1 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      26.0 KW       8.6 KVAR      27.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  940 9-9 PRI     FEEDER AMPS:      1 VOLTAGE DROP:    4. %VD:   .0
PROJECTED POWER FLOW:      15.6 KW       5.1 KVAR      16.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA


==== BUS:  940 9-9 PRI    DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13280 %VD:  -.6
======================= PU BUS VOLTAGE:  1.006        ANGLE:  -3.5 DEGREES
             PROJECTED SPECIAL BUS LOAD:      15.6 KW       5.1 KVAR

LOAD FROM:  935 9-8 PRI     FEEDER AMPS:      1 VOLTAGE DROP:    4. %VD:   .0
PROJECTED POWER FLOW:      15.6 KW       5.1 KVAR      16.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA


==== BUS:  945 F949 L1    DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13309 %VD:  -.8
======================= PU BUS VOLTAGE:  1.008        ANGLE:  -3.8 DEGREES
             PROJECTED SPECIAL BUS LOAD:       5.4 KW       1.8 KVAR

LOAD FROM:  920 F940        FEEDER AMPS:     16 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:     360.4 KW     119.4 KVAR     379.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR        .1 KVA

LOAD   TO:  950 9-12 PRI    FEEDER AMPS:        VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:       8.4 KW       2.7 KVAR       8.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  960 9-13 PRI    FEEDER AMPS:     16 VOLTAGE DROP:   18. %VD:   .1
PROJECTED POWER FLOW:     346.6 KW     114.8 KVAR     365.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .5 KW        .2 KVAR        .5 KVA
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  950 9-12 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13308 %VD:  -.8
======================== PU BUS VOLTAGE:  1.008        ANGLE:  -3.8 DEGREES
              PROJECTED SPECIAL BUS LOAD:        4.2 KW       1.4 KVAR

LOAD FROM:  945 F949 L1      FEEDER AMPS:        VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:      8.4 KW      2.7 KVAR      8.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  955 9-11 PRI     FEEDER AMPS:        VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      4.2 KW      1.4 KVAR      4.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  955 9-11 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13308 %VD:  -.8
======================== PU BUS VOLTAGE:  1.008        ANGLE:  -3.8 DEGREES
              PROJECTED SPECIAL BUS LOAD:        4.2 KW       1.4 KVAR

LOAD FROM:  950 9-12 PRI     FEEDER AMPS:        VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      4.2 KW      1.4 KVAR      4.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  960 9-13 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13291 %VD:  -.7
======================== PU BUS VOLTAGE:  1.007        ANGLE:  -3.9 DEGREES
              PROJECTED SPECIAL BUS LOAD:       18.1 KW       5.9 KVAR

LOAD FROM:  945 F949 L1      FEEDER AMPS:     16 VOLTAGE DROP:   18. %VD:    .1
PROJECTED POWER FLOW:    346.2 KW    114.6 KVAR    364.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .5 KW       .2 KVAR       .5 KVA

LOAD   TO:  963 9-14 PRI     FEEDER AMPS:     15 VOLTAGE DROP:   60. %VD:    .5
PROJECTED POWER FLOW:    328.1 KW    108.7 KVAR    345.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:        1.4 KW       .7 KVAR      1.6 KVA


==== BUS:  963 9-14 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13231 %VD:  -.2
======================== PU BUS VOLTAGE:  1.002        ANGLE:  -3.9 DEGREES
              PROJECTED SPECIAL BUS LOAD:       17.9 KW       5.9 KVAR

LOAD FROM:  960 9-13 PRI     FEEDER AMPS:     15 VOLTAGE DROP:   60. %VD:    .5
PROJECTED POWER FLOW:    326.7 KW    108.0 KVAR    344.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:        1.4 KW       .7 KVAR      1.6 KVA
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                     BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD   TO:  966 9-15 PRI     FEEDER AMPS:     14 VOLTAGE DROP:   16. %VD:    .1
PROJECTED POWER FLOW:     308.8 KW     102.1 KVAR    325.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .4 KW        .2 KVAR       .4 KVA


==== BUS:  966 9-15 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13215 %VD:  -.1
======================== PU BUS VOLTAGE:  1.001       ANGLE:  -3.9 DEGREES
              PROJECTED SPECIAL BUS LOAD:       2.1 KW       .7 KVAR

LOAD FROM:  963 9-14 PRI     FEEDER AMPS:     14 VOLTAGE DROP:   16. %VD:    .1
PROJECTED POWER FLOW:     308.4 KW     102.0 KVAR    324.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .4 KW        .2 KVAR       .4 KVA

LOAD   TO:  969 SW UP        FEEDER AMPS:     14 VOLTAGE DROP:    4. %VD:    .0
PROJECTED POWER FLOW:     306.4 KW     101.3 KVAR    322.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .0 KVAR       .1 KVA


==== BUS:  969 SW UP      DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13210 %VD:  -.1
======================== PU BUS VOLTAGE:  1.001       ANGLE:  -3.9 DEGREES

LOAD FROM:  966 9-15 PRI     FEEDER AMPS:     14 VOLTAGE DROP:    4. %VD:    .0
PROJECTED POWER FLOW:     306.3 KW     101.2 KVAR    322.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .0 KVAR       .1 KVA

LOAD   TO:  972 SW DOWN      FEEDER AMPS:     14 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     306.3 KW     101.2 KVAR    322.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA


==== BUS:  972 SW DOWN    DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13210 %VD:  -.1
======================== PU BUS VOLTAGE:  1.001       ANGLE:  -3.9 DEGREES

LOAD FROM:  969 SW UP        FEEDER AMPS:     14 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     306.3 KW     101.2 KVAR    322.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA

LOAD   TO:  975 9-16 PRI     FEEDER AMPS:     14 VOLTAGE DROP:   62. %VD:    .5
PROJECTED POWER FLOW:     306.3 KW     101.2 KVAR    322.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         1.4 KW        .7 KVAR      1.5 KVA
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  975 9-16 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13148 %VD:   .4
========================= PU BUS VOLTAGE:    .996       ANGLE:  -3.9 DEGREES

LOAD FROM:  972 SW DOWN      FEEDER AMPS:    14 VOLTAGE DROP:   62. %VD:   .5
PROJECTED POWER FLOW:     304.9 KW     100.6 KVAR    321.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         1.4 KW        .7 KVAR      1.5 KVA

LOAD   TO:  977 9-19 PRI     FEEDER AMPS:     1 VOLTAGE DROP:    4. %VD:   .0
PROJECTED POWER FLOW:      16.3 KW       5.4 KVAR     17.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA

LOAD   TO:  980              FEEDER AMPS:    13 VOLTAGE DROP:   25. %VD:   .2
PROJECTED POWER FLOW:     288.6 KW      95.2 KVAR    303.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .5 KW        .2 KVAR       .6 KVA


==== BUS:  977 9-19 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13144 %VD:   .4
========================= PU BUS VOLTAGE:    .996       ANGLE:  -3.9 DEGREES
              PROJECTED SPECIAL BUS LOAD:     16.3 KW       5.4 KVAR

LOAD FROM:  975 9-16 PRI     FEEDER AMPS:     1 VOLTAGE DROP:    4. %VD:   .0
PROJECTED POWER FLOW:      16.3 KW       5.4 KVAR     17.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA


==== BUS:  980            DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13123 %VD:   .6
========================= PU BUS VOLTAGE:    .994       ANGLE:  -3.9 DEGREES

LOAD FROM:  975 9-16 PRI     FEEDER AMPS:    13 VOLTAGE DROP:   25. %VD:   .2
PROJECTED POWER FLOW:     288.0 KW      95.0 KVAR    303.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .5 KW        .2 KVAR       .6 KVA

LOAD   TO:  982 9-20 PRI     FEEDER AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       6.1 KW       2.0 KVAR      6.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA

LOAD   TO:  983 9-25 PRI     FEEDER AMPS:    13 VOLTAGE DROP:   41. %VD:   .3
PROJECTED POWER FLOW:     281.9 KW      93.0 KVAR    296.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .8 KW        .4 KVAR       .9 KVA
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             BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  982 9-20 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13123 %VD:   .6
========================= PU BUS VOLTAGE:   .994        ANGLE:  -3.9 DEGREES
              PROJECTED SPECIAL BUS LOAD:       6.1 KW       2.0 KVAR

LOAD FROM:  980              FEEDER AMPS:          VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      6.1 KW      2.0 KVAR       6.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA


==== BUS:  983 9-25 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13082 %VD:   .9
========================= PU BUS VOLTAGE:   .991        ANGLE:  -4.0 DEGREES
              PROJECTED SPECIAL BUS LOAD:     159.7 KW      52.5 KVAR

LOAD FROM:  980              FEEDER AMPS:     13 VOLTAGE DROP:   41. %VD:   .3
PROJECTED POWER FLOW:    281.1 KW     92.5 KVAR     295.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .8 KW       .4 KVAR        .9 KVA

LOAD   TO:  984 9-25 SEC     TRANSF AMPS:          VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .0 KW       .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:     .0 KW      .0 KVAR      .0 KVA

LOAD   TO:  985 9-34 PRI     FEEDER AMPS:      6 VOLTAGE DROP:    6. %VD:   .0
PROJECTED POWER FLOW:    121.4 KW     40.0 KVAR     127.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .0 KVAR        .1 KVA


==== BUS:  984 9-25 SEC   DESIGN VOLTAGE:   208  BUS VOLTAGE:   206 %VD:   .9
========================= PU BUS VOLTAGE:   .991        ANGLE:  -4.0 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  985 9-34 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13076 %VD:   .9
========================= PU BUS VOLTAGE:   .991        ANGLE:  -4.0 DEGREES
              PROJECTED SPECIAL BUS LOAD:      10.5 KW       3.4 KVAR

LOAD FROM:  983 9-25 PRI     FEEDER AMPS:      6 VOLTAGE DROP:    6. %VD:   .0
PROJECTED POWER FLOW:    121.3 KW     40.0 KVAR     127.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .0 KVAR        .1 KVA

LOAD   TO:  987              FEEDER AMPS:      5 VOLTAGE DROP:   17. %VD:   .1
PROJECTED POWER FLOW:    110.8 KW     36.6 KVAR     116.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR        .2 KVA
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                  BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  987            DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13059 %VD:  1.1
======================== PU BUS VOLTAGE:   .989        ANGLE:  -4.0 DEGREES

LOAD FROM:  985 9-34 PRI    FEEDER AMPS:     5 VOLTAGE DROP:   17. %VD:   .1
PROJECTED POWER FLOW:     110.7 KW     36.5 KVAR    116.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .1 KVAR       .2 KVA

LOAD   TO:  990 9-26 PRI    FEEDER AMPS:     2 VOLTAGE DROP:   11. %VD:   .1
PROJECTED POWER FLOW:      45.2 KW     14.8 KVAR     47.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  992             FEEDER AMPS:     3 VOLTAGE DROP:   43. %VD:   .3
PROJECTED POWER FLOW:      65.5 KW     21.6 KVAR     69.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW       .1 KVAR       .2 KVA


==== BUS:  990 9-26 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13048 %VD:  1.2
======================== PU BUS VOLTAGE:   .988        ANGLE:  -4.0 DEGREES
             PROJECTED SPECIAL BUS LOAD:     45.1 KW       14.8 KVAR

LOAD FROM:  987             FEEDER AMPS:     2 VOLTAGE DROP:   11. %VD:   .1
PROJECTED POWER FLOW:      45.1 KW     14.8 KVAR     47.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA


==== BUS:  992            DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13016 %VD:  1.4
======================== PU BUS VOLTAGE:   .986        ANGLE:  -4.0 DEGREES

LOAD FROM:  987             FEEDER AMPS:     3 VOLTAGE DROP:   43. %VD:   .3
PROJECTED POWER FLOW:      65.3 KW     21.6 KVAR     68.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW       .1 KVAR       .2 KVA

LOAD   TO:  995 9-30 PRI    FEEDER AMPS:     2 VOLTAGE DROP:   30. %VD:   .2
PROJECTED POWER FLOW:      44.9 KW     14.7 KVAR     47.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .0 KVAR       .1 KVA

LOAD   TO:  997 9-32 PRI    FEEDER AMPS:     1 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:      20.4 KW      6.8 KVAR     21.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  995 9-30 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 12985 %VD:  1.6
========================= PU BUS VOLTAGE:   .984       ANGLE:  -4.0 DEGREES
              PROJECTED SPECIAL BUS LOAD:     44.8 KW     14.7 KVAR

LOAD FROM:  992             FEEDER AMPS:      2 VOLTAGE DROP:   30. %VD:    .2
PROJECTED POWER FLOW:      44.8 KW      14.7 KVAR      47.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .0 KVAR        .1 KVA


==== BUS:  997 9-32 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13013 %VD:  1.4
========================= PU BUS VOLTAGE:   .986       ANGLE:  -4.0 DEGREES
              PROJECTED SPECIAL BUS LOAD:     20.4 KW      6.8 KVAR

LOAD FROM:  992             FEEDER AMPS:      1 VOLTAGE DROP:    3. %VD:    .0
PROJECTED POWER FLOW:      20.4 KW       6.8 KVAR      21.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA
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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BUS DATA SUMMARY
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BUS#	NAME	BASE VOLT	PU VOLT	BUS#	NAME	BASE VOLT	PU VOLT
10	GEN G1	2400.00	1.023	15	G1 STEP-UP	2400.00	1.023
20	GEN G2	2400.00	1.017	25	G2 STEP-UP	2400.00	1.017
30	GEN G3	2400.00	1.017	35	G3 STEP-UP	2400.00	1.017
40	GEN G4	4160.00	1.017	50	GEN G5	4160.00	1.017
60	SWGR S	4160.00	1.017	62	SS-1 SEC	480.00	1.017
64	MCC 4&5	480.00	1.017	66	SM1A BLUE	4160.00	1.017
68	BLUE SSS	480.00	1.017	70	SWGR N	4160.00	1.017
80	UTILITY	24900.00	1.000	85	T1 SEC	4160.00	1.017
90	SWGR O	4160.00	1.017	100	FDR 1	4160.00	1.017
105	F1F12 14	4160.00	1.011	110	F1 L14	4160.00	1.010
115	F1 L15	4160.00	1.010	120	F1 L31	4160.00	1.009
121	F1 L63	4160.00	1.008	122	F1 L64	4160.00	1.007
125	F1 L67	4160.00	1.007	130	F1 L613	4160.00	1.007
135	F1 L68	4160.00	1.007	200	FDR 2	4160.00	1.017
205		4160.00	1.015	210	2-3 PRI	4160.00	1.014
215	2-4 PRI	4160.00	1.014	220	2-5 PRI	4160.00	1.014
225	2-3 SEC	480.00	1.014	230	2-4 SEC	208.00	1.014
235	F5 F29	4160.00	1.014	236	F2 F211	4160.00	1.014
240	F1 F213	4160.00	1.013	300	FDR 3	4160.00	1.017
301	F8 F311	4160.00	1.016	303	F713	4160.00	1.016
305	F8 F311	4160.00	1.015	310	F3 19	4160.00	1.014
400	FDR 4	4160.00	1.017	401	4-1 PRI	4160.00	1.016
403	F1 F45	4160.00	1.016	405	F4 10	4160.00	1.015
410	F417 UF1	4160.00	1.014	415	4-6 SEC	208.00	1.014
500	FDR 5	4160.00	1.017	505	F4 F5 F6UF	4160.00	1.016
510	5-1 PRI	4160.00	1.016	512	5-3 PRI	4160.00	1.013
514	5-5 PRI	4160.00	1.013	515	F5 L24	4160.00	1.011
520	5-6 PRI	4160.00	1.011	525	F5 L31	4160.00	1.011
530	F5 L39	4160.00	1.011	531	F3 L41	4160.00	1.010
535	F537 L5	4160.00	1.010	540	F5 L5 UF1	4160.00	1.010
545	F5 L56 UF1	4160.00	1.009	547	5-16 SEC	208.00	1.009
550	F5 L55	4160.00	1.010	555		4160.00	1.009
560	RICH SUB	4160.00	1.008	562	RS SEC	13200.00	1.007
565	5-17 PRI	4160.00	1.008	570	5-18 PRI	4160.00	1.008
575	F5 51	4160.00	1.007	580	F5 L85	4160.00	1.007
585	F5 L87 UF1	4160.00	1.007	590	F5 L8911	4160.00	1.006
591	5-23 SEC	208.00	1.006	593	5-24 SEC	208.00	1.006
595	F5 L8 25	4160.00	1.005	600	O/H BUS	4160.00	1.017
700	FDR 7	4160.00	1.017	705	WELL9 POL	4160.00	1.017
707	7-1 SEC	480.00	1.017	709	F9 F73	4160.00	1.016

BALANCED VOLTAGE DROP AND LOAD FLOW BUS DATA SUMMARY
****

BUS#	NAME	BASE VOLT	PU VOLT	BUS#	NAME	BASE VOLT	PU VOLT
710	F7 L11	4160.00	1.013	715	F7 L13	4160.00	1.013
720	F713	4160.00	1.013	725	7-15 PRI	4160.00	1.011
730	F7 L43	4160.00	1.011	735	F7 L54	4160.00	1.010
740	7-17 PRI	4160.00	1.010	745		4160.00	1.010
750	F7 L72	4160.00	1.010	755	F7-33	4160.00	1.010
760	7-21 PRI	4160.00	1.009	765	7-22 PRI	4160.00	1.009
770	7-23 PRI	4160.00	1.009	775	7-24 PRI	4160.00	1.009
800	FDR 8	4160.00	1.017	805	F8 L11	4160.00	1.012
810	F8 L23	4160.00	1.009	815	F8 L25	4160.00	1.009
817	F8 22	4160.00	1.008	820	F8 30 UF1	4160.00	1.006
825	8-22 PRI	4160.00	1.005	900	FDR 9	4160.00	1.017
905	STEP SEC	13200.00	1.010	910	F 96	13200.00	1.010
915	F910	13200.00	1.010	920	F940	13200.00	1.008
925	()	13200.00	1.007	930	RICH SUB	13200.00	1.007
935	9-8 PRI	13200.00	1.006	940	9-9 PRI	13200.00	1.006
945	F949 L1	13200.00	1.008	950	9-12 PRI	13200.00	1.008
955	9-11 PRI	13200.00	1.008	960	9-13 PRI	13200.00	1.007
963	9-14 PRI	13200.00	1.002	966	9-15 PRI	13200.00	1.001
969	SW UP	13200.00	1.001	972	SW DOWN	13200.00	1.001
975	9-16 PRI	13200.00	.996	977	9-19 PRI	13200.00	.996
980		13200.00	.994	982	9-20 PRI	13200.00	.994
983	9-25 PRI	13200.00	.991	984	9-25 SEC	208.00	.991
985	9-34 PRI	13200.00	.991	987		13200.00	.989
990	9-26 PRI	13200.00	.988	992		13200.00	.986
995	9-30 PRI	13200.00	.984	997	9-32 PRI	13200.00	.986

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
10	GEN G1	15	G1 STEP-UP	FDR	.03	235.10	1000.00	50.56
15	G1 STEP-UP	10	GEN G1	FDR	.03	235.10	999.75	50.56
15	G1 STEP-UP	60	SWGR S	TX2	.58	235.10	999.75	UNKNOW
20	GEN G2	25	G2 STEP-UP	FDR	.00	.00	.00	.00
25	G2 STEP-UP	20	GEN G2	FDR	.00	.00	.00	.00
25	G2 STEP-UP	60	SWGR S	TX2	.00	.00	.00	UNKNOW
30	GEN G3	35	G3 STEP-UP	FDR	.00	.00	.00	.00
35	G3 STEP-UP	30	GEN G3	FDR	.00	.00	.00	.00
35	G3 STEP-UP	60	SWGR S	TX2	.00	.00	.00	UNKNOW
40	GEN G4	70	SWGR N	FDR	.00	.00	.00	.00
50	GEN G5	70	SWGR N	FDR	.00	.00	.00	.00

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
60	SWGR S	15	G1 STEP-UP	TX2	.58	135.64	994.05	UNKNOW
60	SWGR S	25	G2 STEP-UP	TX2	.00	.00	.00	UNKNOW
60	SWGR S	35	G3 STEP-UP	TX2	.00	.00	.00	UNKNOW
60	SWGR S	62	SS-1 SEC	TX2	.00	.02	.17	UNKNOW
60	SWGR S	66	SM1A BLUE	FDR	.00	.03	.25	.01
60	SWGR S	70	SWGR N	FDR	.00	188.71	1382.99	40.58
60	SWGR S	100	FDR 1	FDR	.02	80.08	586.87	34.82
60	SWGR S	200	FDR 2	FDR	.02	77.44	567.52	33.67
60	SWGR S	300	FDR 3	FDR	.01	53.85	394.65	23.41
60	SWGR S	400	FDR 4	FDR	.01	59.97	439.51	26.07
60	SWGR S	500	FDR 5	FDR	.01	38.35	281.04	16.67
62	SS-1 SEC	60	SWGR S	TX2	.00	.20	.17	UNKNOW
62	SS-1 SEC	64	MCC 4&5	FDR	.00	.20	.17	.04
64	MCC 4&5	62	SS-1 SEC	FDR	.00	.20	.17	.04
64	MCC 4&5	68	BLUE SSS	FDR	.00	.30	.25	.06
64	MCC 4&5	90	SWGR O	TX2	.00	.49	.42	UNKNOW
66	SM1A BLUE	60	SWGR S	FDR	.00	.03	.25	.01
66	SM1A BLUE	68	BLUE SSS	TX2	.00	.03	.25	UNKNOW
68	BLUE SSS	64	MCC 4&5	FDR	.00	.30	.25	.06
68	BLUE SSS	66	SM1A BLUE	TX2	.00	.30	.25	UNKNOW
70	SWGR N	40	GEN G4	FDR	.00	.00	.00	.00
70	SWGR N	50	GEN G5	FDR	.00	.00	.00	.00
70	SWGR N	60	SWGR S	FDR	.00	188.71	1383.02	40.58
70	SWGR N	90	SWGR O	FDR	.00	188.71	1383.02	51.00
80	UTILITY	85	T1 SEC	TX2	-1.73	67.03	2890.77	UNKNOW
85	T1 SEC	80	UTILITY	TX2	-1.73	381.15	2793.82	UNKNOW
85	T1 SEC	90	SWGR O	FDR	.01	381.15	2793.82	103.01
90	SWGR O	64	MCC 4&5	TX2	.00	.06	.42	UNKNOW
90	SWGR O	70	SWGR N	FDR	.00	188.71	1383.09	51.00
90	SWGR O	85	T1 SEC	FDR	.01	381.15	2793.56	103.01
90	SWGR O	600	O/H BUS	FDR	.00	.00	.00	.00
90	SWGR O	700	FDR 7	FDR	.02	71.02	520.52	30.88
90	SWGR O	800	FDR 8	FDR	.01	59.17	433.70	25.73
90	SWGR O	900	FDR 9	FDR	.02	65.19	477.84	28.35
100	FDR 1	60	SWGR S	FDR	.02	80.08	586.77	34.82
100	FDR 1	105	F1F12 14	FDR	.62	80.08	586.77	22.43
105	F1F12 14	100	FDR 1	FDR	.62	80.08	583.21	22.43
105	F1F12 14	110	F1 L14	FDR	.08	78.77	573.67	22.06
110	F1 L14	105	F1F12 14	FDR	.08	78.77	573.21	22.06
110	F1 L14	115	F1 L15	FDR	.01	3.68	26.77	1.03

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
110	F1 L14	120	F1 L31	FDR	.15	71.99	523.86	20.16
115	F1 L15	110	F1 L14	FDR	.01	3.68	26.77	1.03
120	F1 L31	110	F1 L14	FDR	.15	71.99	523.10	20.16
120	F1 L31	121	F1 L63	FDR	.09	39.28	285.41	11.00
121	F1 L63	120	F1 L31	FDR	.09	39.28	285.16	11.00
121	F1 L63	122	F1 L64	FDR	.01	14.38	104.43	4.03
121	F1 L63	125	F1 L67	FDR	.02	15.74	114.27	4.41
122	F1 L64	121	F1 L63	FDR	.01	14.38	104.41	4.03
125	F1 L67	121	F1 L63	FDR	.02	15.74	114.25	4.41
125	F1 L67	130	F1 L613	FDR	.02	4.55	33.05	1.28
125	F1 L67	135	F1 L68	FDR	.00	2.08	15.09	.58
130	F1 L613	125	F1 L67	FDR	.02	4.55	33.05	1.28
135	F1 L68	125	F1 L67	FDR	.00	2.08	15.09	.58
200	FDR 2	60	SWGR S	FDR	.02	77.44	567.42	33.67
200	FDR 2	205		FDR	.24	77.44	567.42	21.69
205		200	FDR 2	FDR	.24	77.44	566.09	21.69
205		210	2-3 PRI	FDR	.03	34.68	253.50	9.71
205		235	F5 F29	FDR	.07	32.56	238.05	9.12
210	2-3 PRI	205		FDR	.03	34.68	253.43	9.71
210	2-3 PRI	215	2-4 PRI	FDR	.01	21.63	158.11	6.06
210	2-3 PRI	225	2-3 SEC	TX2	.00	.00	.00	UNKNOW
215	2-4 PRI	210	2-3 PRI	FDR	.01	21.63	158.10	6.06
215	2-4 PRI	220	2-5 PRI	FDR	.01	8.59	62.78	2.41
215	2-4 PRI	230	2-4 SEC	TX2	.00	.00	.00	UNKNOW
220	2-5 PRI	215	2-4 PRI	FDR	.01	8.59	62.77	2.41
225	2-3 SEC	210	2-3 PRI	TX2	.00	.00	.00	UNKNOW
230	2-4 SEC	215	2-4 PRI	TX2	.00	.00	.00	UNKNOW
235	F5 F29	205		FDR	.07	32.56	237.89	9.12
235	F5 F29	236	F2 F211	FDR	.03	26.07	190.42	7.30
236	F2 F211	235	F5 F29	FDR	.03	26.07	190.36	7.30
236	F2 F211	240	F1 F213	FDR	.02	13.03	95.17	3.65
240	F1 F213	236	F2 F211	FDR	.02	13.03	95.16	3.65
300	FDR 3	60	SWGR S	FDR	.01	53.85	394.60	23.41
300	FDR 3	301	F8 F311	FDR	.11	53.85	394.60	15.08
301	F8 F311	300	FDR 3	FDR	.11	53.85	394.17	15.08
301	F8 F311	303	F713	FDR	.03	26.25	192.15	7.35
303	F713	301	F8 F311	FDR	.03	26.25	192.10	7.35
303	F713	305	F8 F311	FDR	.05	26.25	192.10	7.35
305	F8 F311	303	F713	FDR	.05	26.25	191.99	7.35
305	F8 F311	310	F3 19	FDR	.15	24.02	175.70	6.73

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
310	F3 19	305	F8 F311	FDR	.15	24.02	175.45	6.73
400	FDR 4	60	SWGR S	FDR	.01	59.97	439.44	26.07
400	FDR 4	401	4-1 PRI	FDR	.08	59.97	439.44	16.80
401	4-1 PRI	400	FDR 4	FDR	.08	59.97	439.11	16.80
401	4-1 PRI	403	F1 F45	FDR	.06	48.82	357.47	13.67
403	F1 F45	401	4-1 PRI	FDR	.06	48.82	357.25	13.67
403	F1 F45	405	F4 10	FDR	.08	30.84	225.70	8.64
405	F4 10	403	F1 F45	FDR	.08	30.84	225.52	8.64
405	F4 10	410	F417 UF1	FDR	.11	21.18	154.85	5.93
410	F417 UF1	405	F4 10	FDR	.11	21.18	154.69	5.93
410	F417 UF1	415	4-6 SEC	TX2	.00	.00	.00	UNKNOW
415	4-6 SEC	410	F417 UF1	TX2	.00	.00	.00	UNKNOW
500	FDR 5	60	SWGR S	FDR	.01	38.35	281.02	16.67
500	FDR 5	505	F4 F5 F6UF	FDR	.12	38.35	281.02	10.74
505	F4 F5 F6UF	500	FDR 5	FDR	.12	38.35	280.68	10.74
505	F4 F5 F6UF	510	5-1 PRI	FDR	.01	4.59	33.61	1.29
505	F4 F5 F6UF	512	5-3 PRI	FDR	.28	33.76	247.07	9.46
510	5-1 PRI	505	F4 F5 F6UF	FDR	.01	4.59	33.61	1.29
512	5-3 PRI	505	F4 F5 F6UF	FDR	.28	33.76	246.39	9.46
512	5-3 PRI	514	5-5 PRI	FDR	.00	.76	5.53	.21
512	5-3 PRI	515	F5 L24	FDR	.19	30.91	225.62	8.66
514	5-5 PRI	512	5-3 PRI	FDR	.00	.76	5.53	.21
515	F5 L24	512	5-3 PRI	FDR	.19	30.91	225.20	8.66
515	F5 L24	520	5-6 PRI	FDR	.01	.75	5.49	.72
515	F5 L24	525	F5 L31	FDR	.03	28.95	210.89	8.11
520	5-6 PRI	515	F5 L24	FDR	.01	.75	5.49	.72
525	F5 L31	515	F5 L24	FDR	.03	28.95	210.83	8.11
525	F5 L31	530	F5 L39	FDR	.01	.75	5.46	.21
525	F5 L31	531	F3 L41	FDR	.04	14.25	103.78	3.99
525	F5 L31	535	F537 L5	FDR	.09	12.74	92.78	3.57
530	F5 L39	525	F5 L31	FDR	.01	.75	5.46	.21
531	F3 L41	525	F5 L31	FDR	.04	14.25	103.75	3.99
531	F3 L41	535	F537 L5	FDR	.05	11.90	86.63	3.33
535	F537 L5	525	F5 L31	FDR	.09	12.74	92.69	3.57
535	F537 L5	531	F3 L41	FDR	.05	11.90	86.59	3.33
535	F537 L5	540	F5 L5 UF1	FDR	.00	2.39	17.42	.67
535	F537 L5	555		FDR	.12	21.50	156.43	7.79
540	F5 L5 UF1	535	F537 L5	FDR	.00	2.39	17.42	.67
540	F5 L5 UF1	545	F5 L56 UF1	FDR	.05	1.77	12.89	.96
540	F5 L5 UF1	550	F5 L55	FDR	.00	.31	2.28	.09

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
545	F5 L56 UF1	540	F5 L5 UF1	FDR	.05	1.77	12.89	.96
545	F5 L56 UF1	547	5-16 SEC	TX2	.00	.00	.00	UNKNOW
547	5-16 SEC	545	F5 L56 UF1	TX2	.00	.00	.00	UNKNOW
550	F5 L55	540	F5 L5 UF1	FDR	.00	.31	2.28	.09
555		535	F537 L5	FDR	.12	21.50	156.24	7.79
555		560	RICH SUB	FDR	.09	3.78	27.47	1.37
555		565	5-17 PRI	FDR	.10	17.72	128.77	6.42
560	RICH SUB	555		FDR	.09	3.78	27.44	1.37
560	RICH SUB	562	RS SEC	TX2	.12	3.78	27.44	UNKNOW
562	RS SEC	560	RICH SUB	TX2	.12	1.19	27.41	UNKNOW
562	RS SEC	930	RICH SUB	FDR	.00	1.19	27.41	.85
565	5-17 PRI	555		FDR	.10	17.72	128.64	6.42
565	5-17 PRI	570	5-18 PRI	FDR	.00	1.21	8.78	.44
565	5-17 PRI	575	F5 51	FDR	.03	15.76	114.46	5.71
570	5-18 PRI	565	5-17 PRI	FDR	.00	1.21	8.78	.44
575	F5 51	565	5-17 PRI	FDR	.03	15.76	114.42	5.71
575	F5 51	580	F5 L85	FDR	.07	15.47	112.28	5.61
580	F5 L85	575	F5 51	FDR	.07	15.47	112.21	5.61
580	F5 L85	585	F5 L87 UF1	FDR	.01	3.53	25.63	1.28
580	F5 L85	590	F5 L8911	FDR	.05	10.74	77.87	7.67
585	F5 L87 UF1	580	F5 L85	FDR	.01	3.53	25.63	1.28
590	F5 L8911	580	F5 L85	FDR	.05	10.74	77.83	7.67
590	F5 L8911	591	5-23 SEC	TX2	.00	.00	.00	UNKNOW
590	F5 L8911	593	5-24 SEC	TX2	.00	.00	.00	UNKNOW
590	F5 L8911	595	F5 L8 25	FDR	.11	4.81	34.87	3.44
591	5-23 SEC	590	F5 L8911	TX2	.00	.00	.00	UNKNOW
593	5-24 SEC	590	F5 L8911	TX2	.00	.00	.00	UNKNOW
595	F5 L8 25	590	F5 L8911	FDR	.11	4.81	34.83	3.44
600	O/H BUS	90	SWGR O	FDR	.00	.00	.00	.00
700	FDR 7	90	SWGR O	FDR	.02	71.02	520.43	30.88
700	FDR 7	705	WELL9 POL	FDR	.02	71.02	520.43	19.89
705	WELL9 POL	700	FDR 7	FDR	.02	71.02	520.34	19.89
705	WELL9 POL	707	7-1 SEC	TX2	.00	.00	.00	UNKNOW
705	WELL9 POL	709	F9 F73	FDR	.07	64.90	475.55	18.18
707	7-1 SEC	705	WELL9 POL	TX2	.00	.00	.00	UNKNOW
709	F9 F73	705	WELL9 POL	FDR	.07	64.90	475.23	18.18
709	F9 F73	710	F7 L11	FDR	.27	52.60	385.10	14.73
710	F7 L11	709	F9 F73	FDR	.27	52.60	384.08	14.73
710	F7 L11	715	F7 L13	FDR	.01	3.11	22.74	.87
710	F7 L11	720	F713	FDR	.09	37.03	270.40	10.37

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
715	F7 L13	710	F7 L11	FDR	.01	3.11	22.73	.87
720	F713	710	F7 L11	FDR	.09	37.03	270.14	10.37
720	F713	725	7-15 PRI	FDR	.20	32.45	236.75	9.09
725	7-15 PRI	720	F713	FDR	.20	32.45	236.28	9.09
725	7-15 PRI	730	F7 L43	FDR	.01	1.77	12.92	.50
725	7-15 PRI	735	F7 L54	FDR	.03	17.10	124.54	4.79
730	F7 L43	725	7-15 PRI	FDR	.01	1.77	12.92	.50
735	F7 L54	725	7-15 PRI	FDR	.03	17.10	124.51	4.79
735	F7 L54	740	7-17 PRI	FDR	.01	2.48	18.08	.70
735	F7 L54	745		FDR	.04	11.52	83.84	3.23
740	7-17 PRI	735	F7 L54	FDR	.01	2.48	18.08	.70
745		735	F7 L54	FDR	.04	11.52	83.81	3.23
745		750	F7 L72	FDR	.01	4.12	29.99	1.15
745		760	7-21 PRI	FDR	.05	7.40	53.82	2.07
750	F7 L72	745		FDR	.01	4.12	29.99	1.15
750	F7 L72	755	F7-33	FDR	.00	1.02	7.42	.29
755	F7-33	750	F7 L72	FDR	.00	1.02	7.42	.29
760	7-21 PRI	745		FDR	.05	7.40	53.79	2.07
760	7-21 PRI	765	7-22 PRI	FDR	.02	5.62	40.91	1.58
765	7-22 PRI	760	7-21 PRI	FDR	.02	5.62	40.90	1.58
765	7-22 PRI	770	7-23 PRI	FDR	.01	2.52	18.36	.71
770	7-23 PRI	765	7-22 PRI	FDR	.01	2.52	18.36	.71
770	7-23 PRI	775	7-24 PRI	FDR	.01	1.77	12.88	.50
775	7-24 PRI	770	7-23 PRI	FDR	.01	1.77	12.88	.50
800	FDR 8	90	SWGR O	FDR	.01	59.17	433.64	25.73
800	FDR 8	805	F8 L11	FDR	.55	59.17	433.64	16.58
805	F8 L11	800	FDR 8	FDR	.55	59.17	431.30	16.58
805	F8 L11	810	F8 L23	FDR	.28	54.73	398.94	15.33
810	F8 L23	805	F8 L11	FDR	.28	54.73	397.83	15.33
810	F8 L23	815	F8 L25	FDR	.00	.63	4.59	.18
810	F8 L23	817	F8 22	FDR	.04	43.34	315.05	12.14
815	F8 L25	810	F8 L23	FDR	.00	.63	4.59	.18
817	F8 22	810	F8 L23	FDR	.04	43.34	314.91	12.14
817	F8 22	820	F8 30 UF1	FDR	.21	36.84	267.65	10.32
820	F8 30 UF1	817	F8 22	FDR	.21	36.84	267.10	10.32
820	F8 30 UF1	825	8-22 PRI	FDR	.17	19.79	143.50	5.54
825	8-22 PRI	820	F8 30 UF1	FDR	.17	19.79	143.25	5.54
900	FDR 9	90	SWGR O	FDR	.02	65.19	477.76	28.35
900	FDR 9	905	STEP SEC	TX2	.69	65.19	477.76	UNKNOW
905	STEP SEC	900	FDR 9	TX2	.69	20.55	474.53	UNKNOW

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
905	STEP SEC	910	F 96	FDR	.02	20.55	474.53	5.76
910	F 96	905	STEP SEC	FDR	.02	20.55	474.44	5.76
910	F 96	915	F910	FDR	.03	19.72	455.32	5.52
915	F910	910	F 96	FDR	.03	19.72	455.20	5.52
915	F910	920	F940	FDR	.12	16.95	391.23	4.75
920	F940	915	F910	FDR	.12	16.95	390.75	4.75
920	F940	945	F949 L1	FDR	.02	16.47	379.75	4.61
925	()	930	RICH SUB	FDR	.01	1.19	27.41	.85
925	()	935	9-8 PRI	FDR	.01	1.19	27.41	1.13
930	RICH SUB	562	RS SEC	FDR	.00	1.19	27.41	.85
930	RICH SUB	925	()	FDR	.01	1.19	27.41	.85
935	9-8 PRI	925	()	FDR	.01	1.19	27.41	1.13
935	9-8 PRI	940	9-9 PRI	FDR	.03	.71	16.45	.68
940	9-9 PRI	935	9-8 PRI	FDR	.03	.71	16.44	.68
945	F949 L1	920	F940	FDR	.02	16.47	379.67	4.61
945	F949 L1	950	9-12 PRI	FDR	.01	.38	8.80	.36
945	F949 L1	960	9-13 PRI	FDR	.14	15.84	365.15	8.61
950	9-12 PRI	945	F949 L1	FDR	.01	.38	8.79	.36
950	9-12 PRI	955	9-11 PRI	FDR	.00	.19	4.40	.18
955	9-11 PRI	950	9-12 PRI	FDR	.00	.19	4.40	.18
960	9-13 PRI	945	F949 L1	FDR	.14	15.84	364.64	8.61
960	9-13 PRI	963	9-14 PRI	FDR	.45	15.01	345.64	8.16
963	9-14 PRI	960	9-13 PRI	FDR	.45	15.01	344.08	8.16
963	9-14 PRI	966	9-15 PRI	FDR	.12	14.19	325.24	7.71
966	9-15 PRI	963	9-14 PRI	FDR	.12	14.19	324.84	7.71
966	9-15 PRI	969	SW UP	FDR	.03	14.10	322.67	7.66
969	SW UP	966	9-15 PRI	FDR	.03	14.10	322.56	7.66
969	SW UP	972	SW DOWN	FDR	.00	14.10	322.56	3.03
972	SW DOWN	969	SW UP	FDR	.00	14.10	322.56	3.03
972	SW DOWN	975	9-16 PRI	FDR	.47	14.10	322.56	7.66
975	9-16 PRI	972	SW DOWN	FDR	.47	14.10	321.04	7.66
975	9-16 PRI	977	9-19 PRI	FDR	.03	.75	17.18	.41
975	9-16 PRI	980		FDR	.19	13.34	303.86	7.25
977	9-19 PRI	975	9-16 PRI	FDR	.03	.75	17.17	.41
980		975	9-16 PRI	FDR	.19	13.34	303.30	7.25
980		982	9-20 PRI	FDR	.00	.28	6.42	.15
980		983	9-25 PRI	FDR	.31	13.06	296.88	7.10
982	9-20 PRI	980		FDR	.00	.28	6.42	.15
983	9-25 PRI	980		FDR	.31	13.06	295.94	7.10
983	9-25 PRI	984	9-25 SEC	TX2	.00	.00	.00	UNKNOW

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
983	9-25 PRI	985	9-34 PRI	FDR	.04	5.64	127.82	3.07
984	9-25 SEC	983	9-25 PRI	TX2	.00	.00	.00	UNKNOW
985	9-34 PRI	983	9-25 PRI	FDR	.04	5.64	127.76	3.07
985	9-34 PRI	987		FDR	.13	5.15	116.72	2.80
987		985	9-34 PRI	FDR	.13	5.15	116.57	2.80
987		990	9-26 PRI	FDR	.08	2.10	47.54	1.14
987		992		FDR	.33	3.05	69.03	1.66
990	9-26 PRI	987		FDR	.08	2.10	47.50	1.14
992		987		FDR	.33	3.05	68.80	1.66
992		995	9-30 PRI	FDR	.23	2.10	47.28	1.75
992		997	9-32 PRI	FDR	.02	.95	21.52	.52
995	9-30 PRI	992		FDR	.23	2.10	47.17	1.75
997	9-32 PRI	992		FDR	.02	.95	21.51	.52

NOTE: FOR FEEDERS, RATING% = LOAD FLOW AMPS / FLA.
FLA = LIBRARY FLA EXCLUDING DUCT BANK AND TEMP. DERATING FOR CABLES.
FLA = BRANCH RECORD INPUT FLA FOR IMPEDANCE DATA.

NOTE: FOR TRANSFORMERS, RATING% = LOAD FLOW KVA / TRANSFORMER FULL LOAD KVA.

130 BUSES

*** T O T A L S Y S T E M L O S S E S ***
44.2 KW 242.8 KVAR

APPENDIX H

Load Flow Analysis - Case 3

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

DATE: 27 NOV 95
TIME: 9 10 AM

ALL INFORMATION PRESENTED IS FOR REVIEW, APPROVAL
INTERPRETATION AND APPLICATION BY A REGISTERED
ENGINEER ONLY

DAPPER (LOAD FLOW AND VOLTAGE DROP MINI/MICRO VERSION 4.5 LEVEL 1.0)

SWING GENERATORS

BUS NO	ID	STAT	VOLTAGE	ANGLE
80	6	1	1.000	.000

PV GENERATORS

BUS NO	ID	STAT	VOLTAGE	kW	kVARMIN	kVARMAX	PARTICIPATION
10	1	1	1.000	1000.	0.	0.	1.000
20	2	1	1.000	0.	0.	0.	1.000
30	3	1	1.000	0.	0.	0.	1.000
40	4	1	1.000	0.	0.	0.	1.000
50	5	1	1.000	0.	0.	0.	1.000

NOTICE: BRANCH 725 7-15 PRI TO 730 F7 L43 IS OUT OF SERVICE
NOTICE: BRANCH 735 F7 L54 TO 740 7-17 PRI IS OUT OF SERVICE
NOTICE: BRANCH 750 F7 L72 TO 755 F7-33 IS OUT OF SERVICE
NOTICE: BRANCH 745 TO 760 7-21 PRI IS OUT OF SERVICE
NOTICE: BRANCH 760 7-21 PRI TO 765 7-22 PRI IS OUT OF SERVICE
NOTICE: BRANCH 765 7-22 PRI TO 770 7-23 PRI IS OUT OF SERVICE
NOTICE: BRANCH 770 7-23 PRI TO 775 7-24 PRI IS OUT OF SERVICE
NOTICE: BRANCH 800 FDR 8 TO 805 F8 L11 IS OUT OF SERVICE
NOTICE: BRANCH 805 F8 L11 TO 810 F8 L23 IS OUT OF SERVICE
NOTICE: BRANCH 810 F8 L23 TO 815 F8 L25 IS OUT OF SERVICE
NOTICE: BRANCH 810 F8 L23 TO 817 F8 22 IS OUT OF SERVICE
NOTICE: BRANCH 820 F8 30 UF1 TO 825 8-22 PRI IS OUT OF SERVICE
NOTICE: BRANCH 920 F940 TO 925 () IS OUT OF SERVICE
NOTICE: BRANCH 945 F949 L1 TO 950 9-12 PRI IS OUT OF SERVICE
NOTICE: BRANCH 950 9-12 PRI TO 955 9-11 PRI IS OUT OF SERVICE
NOTICE: BRANCH 975 9-16 PRI TO 977 9-19 PRI IS OUT OF SERVICE
NOTICE: BRANCH 980 TO 982 9-20 PRI IS OUT OF SERVICE
NOTICE: BRANCH 992 TO 995 9-30 PRI IS OUT OF SERVICE
NOTICE: BRANCH 121 F1 L63 TO 125 F1 L67 IS OUT OF SERVICE
NOTICE: BRANCH 125 F1 L67 TO 130 F1 L613 IS OUT OF SERVICE
NOTICE: BRANCH 125 F1 L67 TO 135 F1 L68 IS OUT OF SERVICE
NOTICE: BRANCH 205 TO 210 2-3 PRI IS OUT OF SERVICE
NOTICE: BRANCH 400 FDR 4 TO 401 4-1 PRI IS OUT OF SERVICE
NOTICE: BRANCH 305 F8 F311 TO 310 F3 19 IS OUT OF SERVICE
NOTICE: BRANCH 405 F4 10 TO 410 F417 UF1 IS OUT OF SERVICE
NOTICE: BRANCH 505 F4 F5 F6UF TO 510 5-1 PRI IS OUT OF SERVICE
NOTICE: BRANCH 515 F5 L24 TO 520 5-6 PRI IS OUT OF SERVICE
NOTICE: BRANCH 525 F5 L31 TO 530 F5 L39 IS OUT OF SERVICE
NOTICE: BRANCH 535 F537 L5 TO 540 F5 L5 UF1 IS OUT OF SERVICE
NOTICE: BRANCH 540 F5 L5 UF1 TO 545 F5 L56 UF1 IS OUT OF SERVICE
NOTICE: BRANCH 540 F5 L5 UF1 TO 550 F5 L55 IS OUT OF SERVICE
NOTICE: BRANCH 565 5-17 PRI TO 570 5-18 PRI IS OUT OF SERVICE
NOTICE: BRANCH 580 F5 L85 TO 585 F5 L87 UF1 IS OUT OF SERVICE
NOTICE: BRANCH 580 F5 L85 TO 590 F5 L8911 IS OUT OF SERVICE
NOTICE: BRANCH 590 F5 L8911 TO 595 F5 L8 25 IS OUT OF SERVICE

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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NOTICE: BRANCH 303 F713       TO 305 F8 F311    IS OUT OF SERVICE
NOTICE: BRANCH 817 F8 22      TO 820 F8 30 UF1  IS OUT OF SERVICE
NOTICE: BRANCH 210 2-3 PRI    TO 215 2-4 PRI    IS OUT OF SERVICE
NOTICE: BRANCH 215 2-4 PRI    TO 220 2-5 PRI    IS OUT OF SERVICE
NOTICE: BRANCH 512 5-3 PRI    TO 514 5-5 PRI    IS OUT OF SERVICE
NOTICE: BRANCH 210 2-3 PRI    TO 225 2-3 SEC    IS OUT OF SERVICE
NOTICE: BRANCH 215 2-4 PRI    TO 230 2-4 SEC    IS OUT OF SERVICE
NOTICE: BRANCH 410 F417 UF1   TO 415 4-6 SEC    IS OUT OF SERVICE
NOTICE: BRANCH 545 F5 L56 UF1 TO 547 5-16 SEC   IS OUT OF SERVICE
NOTICE: BRANCH 590 F5 L8911   TO 591 5-23 SEC   IS OUT OF SERVICE
NOTICE: BRANCH 590 F5 L8911   TO 593 5-24 SEC   IS OUT OF SERVICE
NOTICE: BRANCH 300 FDR 3      TO 301 F8 F311    IS OUT OF SERVICE
NOTICE: BRANCH 301 F8 F311    TO 303 F713       IS OUT OF SERVICE
NOTICE: BRANCH 401 4-1 PRI    TO 403 F1 F45     IS OUT OF SERVICE
NOTICE: BRANCH 403 F1 F45     TO 405 F4 10      IS OUT OF SERVICE
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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

F E E D E R   D A T A

FEEDER FROM NO	NAME	FEEDER TO NO	NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE	DUCT	INSUL
10	GEN G1	60	SWGR S	1	2400.	50. FT	500	C	M	XLP
	IMPEDANCE:	.0300 + J	.0526 OHMS/M FEET				STATUS: EXISTING			
20	GEN G2	60	SWGR S	1	2400.	50. FT	500	C	M	XLP
	IMPEDANCE:	.0300 + J	.0526 OHMS/M FEET				STATUS: EXISTING			
30	GEN G3	60	SWGR S	1	2400.	50. FT	500	C	M	XLP
	IMPEDANCE:	.0300 + J	.0526 OHMS/M FEET				STATUS: EXISTING			
40	GEN G4	70	SWGR N	1	2400.	50. FT	500	C	M	XLP
	IMPEDANCE:	.0300 + J	.0526 OHMS/M FEET				STATUS: EXISTING			
50	GEN G5	70	SWGR N	1	2400.	50. FT	500	C	M	XLP
	IMPEDANCE:	.0300 + J	.0526 OHMS/M FEET				STATUS: EXISTING			
60	SWGR S	66	SM1A BLUE	1	2400.	50. FT	500	C	M	XLP
	IMPEDANCE:	.0300 + J	.0526 OHMS/M FEET				STATUS: EXISTING			
60	SWGR S	70	SWGR N	1	2400.	5. FT	500	C	M	XLP
	IMPEDANCE:	.0300 + J	.0526 OHMS/M FEET				STATUS: EXISTING			
60	SWGR S	100	FDR 1	1	2400.	50. FT	4/0	A	N	XLP
	IMPEDANCE:	.1050 + J	.0410 OHMS/M FEET				STATUS: EXISTING			
60	SWGR S	200	FDR 2	1	2400.	50. FT	4/0	A	N	XLP
	IMPEDANCE:	.1050 + J	.0410 OHMS/M FEET				STATUS: EXISTING			
60	SWGR S	300	FDR 3	1	2400.	50. FT	4/0	A	N	XLP
	IMPEDANCE:	.1050 + J	.0410 OHMS/M FEET				STATUS: EXISTING			
60	SWGR S	400	FDR 4	1	2400.	50. FT	4/0	A	N	XLP
	IMPEDANCE:	.1050 + J	.0410 OHMS/M FEET				STATUS: EXISTING			
60	SWGR S	500	FDR 5	1	2400.	50. FT	4/0	A	N	XLP
	IMPEDANCE:	.1050 + J	.0410 OHMS/M FEET				STATUS: EXISTING			
62	SS-1 SEC	64	MCC 4&5	1	480.	50. FT	500	C	M	XLP
	IMPEDANCE:	.0300 + J	.0526 OHMS/M FEET				STATUS: EXISTING			
64	MCC 4&5	68	BLUE SSS	1	480.	50. FT	500	C	M	XLP
	IMPEDANCE:	.0300 + J	.0526 OHMS/M FEET				STATUS: EXISTING			
70	SWGR N	90	SWGR O	1	2400.	10. FT	500	A	M	XLP
	IMPEDANCE:	.0453 + J	.0444 OHMS/M FEET				STATUS: EXISTING			

F E E D E R   D A T A

FEEDER FROM NO	NAME	FEEDER TO NO	NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE	DUCT	INSUL
85	T1 SEC	90	SWGR O	1	2400.	10. FT	500	A	M	XLP
	IMPEDANCE:	.0453 + J	.0444 OHMS/M FEET				STATUS:	EXISTING		
90	SWGR O	600	O/H BUS	1	2400.	50. FT	4/0	A	N	XLP
	IMPEDANCE:	.1050 + J	.0410 OHMS/M FEET				STATUS:	EXISTING		
90	SWGR O	700	FDR 7	1	2400.	50. FT	4/0	A	N	XLP
	IMPEDANCE:	.1050 + J	.0410 OHMS/M FEET				STATUS:	EXISTING		
90	SWGR O	800	FDR 8	1	2400.	50. FT	4/0	A	N	XLP
	IMPEDANCE:	.1050 + J	.0410 OHMS/M FEET				STATUS:	EXISTING		
90	SWGR O	900	FDR 9	1	2400.	50. FT	4/0	A	N	XLP
	IMPEDANCE:	.1050 + J	.0410 OHMS/M FEET				STATUS:	EXISTING		
100	FDR 1	105	F1F12 14	1	2400.	1500. FT	4/0	A	B	OH-2
	IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING		
105	F1F12 14	110	F1 L14	1	2400.	200. FT	4/0	A	B	OH-2
	IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING		
110	F1 L14	115	F1 L15	1	2400.	300. FT	4/0	A	B	OH-2
	IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING		
110	F1 L14	120	F1 L31	1	2400.	400. FT	4/0	A	B	OH-2
	IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING		
120	F1 L31	121	F1 L63	1	2400.	450. FT	4/0	A	B	OH-2
	IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING		
121	F1 L63	122	F1 L64	1	2400.	200. FT	4/0	A	B	OH-2
	IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING		
200	FDR 2	205		1	2400.	600. FT	4/0	A	B	OH-2
	IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING		
205		235	F5 F29	1	2400.	400. FT	4/0	A	B	OH-2
	IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING		
235	F5 F29	236	F2 F211	1	2400.	250. FT	4/0	A	B	OH-2
	IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING		
236	F2 F211	240	F1 F213	1	2400.	250. FT	4/0	A	B	OH-2
	IMPEDANCE:	.0900 + J	.1200 OHMS/M FEET				STATUS:	EXISTING		

```
                          F E E D E R   D A T A
===========================================================================
FEEDER FROM      FEEDER TO        QTY  VOLTS   LENGTH      FEEDER  DESCRIPTION
 NO NAME          NO NAME         /PH   L-L                SIZE TYPE  DUCT  INSUL
===========================================================================

 500 FDR 5        505 F4 F5 F6UF   1    2400.   625. FT   4/0    A     B    OH-2
     IMPEDANCE:   .0900 + J  .1200 OHMS/M FEET                STATUS: EXISTING

 505 F4 F5 F6UF   512 5-3 PRI      1    2400.  1600. FT   4/0    A     B    OH-2
     IMPEDANCE:   .0900 + J  .1200 OHMS/M FEET                STATUS: EXISTING

 512 5-3 PRI      515 F5 L24       1    2400.  1200. FT   4/0    A     B    OH-2
     IMPEDANCE:   .0900 + J  .1200 OHMS/M FEET                STATUS: EXISTING

 515 F5 L24       525 F5 L31       1    2400.   200. FT   4/0    A     B    OH-2
     IMPEDANCE:   .0900 + J  .1200 OHMS/M FEET                STATUS: EXISTING

 525 F5 L31       531 F3 L41       1    2400.   500. FT   4/0    A     B    OH-2
     IMPEDANCE:   .0900 + J  .1200 OHMS/M FEET                STATUS: EXISTING

 525 F5 L31       535 F537 L5      1    2400.  1400. FT   4/0    A     B    OH-2
     IMPEDANCE:   .0900 + J  .1200 OHMS/M FEET                STATUS: EXISTING

 531 F3 L41       535 F537 L5      1    2400.   900. FT   4/0    A     B    OH-2
     IMPEDANCE:   .0900 + J  .1200 OHMS/M FEET                STATUS: EXISTING

 535 F537 L5      555              1    2400.   800. FT   2/0    A     B    OH-2
     IMPEDANCE:   .1410 + J  .1250 OHMS/M FEET                STATUS: EXISTING

 555              560 RICH SUB     1    2400.  3200. FT   2/0    A     B    OH-2
     IMPEDANCE:   .1410 + J  .1250 OHMS/M FEET                STATUS: EXISTING

 555              565 5-17 PRI     1    2400.   800. FT   2/0    A     B    OH-2
     IMPEDANCE:   .1410 + J  .1250 OHMS/M FEET                STATUS: EXISTING

 562 RS SEC       930 RICH SUB     1    7200.     5. FT   4      A     B    OH-2
     IMPEDANCE:   .4360 + J  .1380 OHMS/M FEET                STATUS: EXISTING

 565 5-17 PRI     575 F5 51        1    2400.   300. FT   2/0    A     B    OH-2
     IMPEDANCE:   .1410 + J  .1250 OHMS/M FEET                STATUS: EXISTING

 575 F5 51        580 F5 L85       1    2400.   600. FT   2/0    A     B    OH-2
     IMPEDANCE:   .1410 + J  .1250 OHMS/M FEET                STATUS: EXISTING

 700 FDR 7        705 WELL9 POL    1    2400.    50. FT   4/0    A     B    OH-2
     IMPEDANCE:   .0900 + J  .1200 OHMS/M FEET                STATUS: EXISTING

 705 WELL9 POL    709 F9 F73       1    2400.   200. FT   4/0    A     B    OH-2
     IMPEDANCE:   .0900 + J  .1200 OHMS/M FEET                STATUS: EXISTING
```

F E E D E R D A T A

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE	DUCT	INSUL
709 F9 F73	710 F7 L11	1	2400.	1000. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
710 F7 L11	715 F7 L13	1	2400.	500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
710 F7 L11	720 F713	1	2400.	500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
720 F713	725 7-15 PRI	1	2400.	1200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
725 7-15 PRI	735 F7 L54	1	2400.	350. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
735 F7 L54	745	1	2400.	625. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
745	750 F7 L72	1	2400.	525. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
905 STEP SEC	910 F 96	1	7200.	600. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
910 F 96	915 F910	1	7200.	800. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
915 F910	920 F940	1	7200.	4500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
920 F940	945 F949 L1	1	7200.	800. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
925 ()	930 RICH SUB	1	7200.	1500. FT	4	A	B	OH-2
IMPEDANCE:	.4360 + J .1380 OHMS/M FEET					STATUS: EXISTING		
925 ()	935 9-8 PRI	1	7200.	1000. FT	6	A	B	OH-2
IMPEDANCE:	.6900 + J .1440 OHMS/M FEET					STATUS: EXISTING		
935 9-8 PRI	940 9-9 PRI	1	7200.	5000. FT	6	A	B	OH-2
IMPEDANCE:	.6900 + J .1440 OHMS/M FEET					STATUS: EXISTING		
945 F949 L1	960 9-13 PRI	1	7200.	2200. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE	DUCT	INSUL
960 9-13 PRI	963 9-14 PRI	1	7200.	7600. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
963 9-14 PRI	966 9-15 PRI	1	7200.	2200. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
966 9-15 PRI	969 SW UP	1	7200.	600. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
969 SW UP	972 SW DOWN	1	7200.	5. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
972 SW DOWN	975 9-16 PRI	1	7200.	8400. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
975 9-16 PRI	980	1	7200.	3500. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
980	983 9-25 PRI	1	7200.	6000. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
983 9-25 PRI	985 9-34 PRI	1	7200.	2000. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
985 9-34 PRI	987	1	7200.	6400. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
987	990 9-26 PRI	1	7200.	9800. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
987	992	1	7200.	27000. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		
992	997 9-32 PRI	1	7200.	5000. FT	2	A	B	OH-2
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

T R A N S F O R M E R   D A T A

PRIMARY RECORD NO NAME	VOLTS L-L	PRI FLA	* SECONDARY RECORD NO NAME	VOLTS L-L	SEC FLA	NOMINAL KVA
60 SWGR S	2400.	72.	62 SS-1 SEC	480.	361.	300.0
IMPEDANCE:	.7816 + J 4.5331 PERCENT					
66 SM1A BLUE	2400.	120.	68 BLUE SSS	480.	601.	500.0
IMPEDANCE:	.8156 + J 4.7302 PERCENT					
80 UTILITY	24900.	58.	85 T1 SEC	2400.	601.	2500.0
IMPEDANCE:	.5546 + J 5.9341 PERCENT		TRANSFORMER FIXED TAP:			-5.0 %
90 SWGR O	2400.	72.	64 MCC 4&5	480.	361.	300.0
IMPEDANCE:	.5709 + J 3.3111 PERCENT					
560 RICH SUB	2400.	144.	562 RS SEC	7200.	48.	600.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
705 WELL9 POL	2400.	36.	707 7-1 SEC	480.	180.	150.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					
900 FDR 9	2400.	361.	905 STEP SEC	7200.	120.	1500.0
IMPEDANCE:	.7816 + J 4.5331 PERCENT					
983 9-25 PRI	7200.	40.	984 9-25 SEC	208.	1388.	500.0
IMPEDANCE:	.9345 + J 5.4200 PERCENT					

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

B U S   S P E C I A L   S T U D Y   D A T A

* NO * NAME	* KW	* KVAR	* LOAD TYPE
120 F1 L31	43.	14.	CONSTANT Z LOAD
121 F1 L63	43.	14.	CONSTANT Z LOAD
122 F1 L64	74.	24.	CONSTANT Z LOAD
235 F5 F29	44.	14.	CONSTANT Z LOAD
236 F2 F211	88.	29.	CONSTANT Z LOAD
240 F1 F213	88.	29.	CONSTANT Z LOAD
525 F5 L31	8.	3.	CONSTANT Z LOAD
565 5-17 PRI	5.	2.	CONSTANT Z LOAD
580 F5 L85	8.	3.	CONSTANT Z LOAD
705 WELL9 POL	41.	14.	CONSTANT Z LOAD
709 F9 F73	83.	27.	CONSTANT Z LOAD
710 F7 L11	21.	7.	CONSTANT Z LOAD
715 F7 L13	21.	7.	CONSTANT Z LOAD
735 F7 L54	8.	3.	CONSTANT Z LOAD
750 F7 L72	21.	7.	CONSTANT Z LOAD
910 F 96	18.	6.	CONSTANT Z LOAD
935 9-8 PRI	10.	3.	CONSTANT Z LOAD
940 9-9 PRI	15.	5.	CONSTANT Z LOAD
945 F949 L1	4.	1.	CONSTANT Z LOAD
963 9-14 PRI	18.	6.	CONSTANT Z LOAD
983 9-25 PRI	157.	51.	CONSTANT Z LOAD
990 9-26 PRI	34.	11.	CONSTANT Z LOAD
997 9-32 PRI	24.	8.	CONSTANT Z LOAD

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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        *** SOLUTION COMMENTS ***
        =========================

    SOLUTION PARAMETERS

    BRANCH VOLTAGE CRITERIA                    :  4.00 %
    BUS VOLTAGE CRITERIA                       :  5.00 %
    ACCELERATION FACTOR FOR 'PV' GENERATORS    :  1.00
    ACCELERATION FACTOR FOR CONSTANT KVA LOADS:   1.00
    EXACT(ITERATIVE) SOLUTION                  :  YES

    <<PERCENT VOLTAGE DROPS ARE BASED ON NOMINAL DESIGN VOLTAGES>>

TOF SIZE:  292

LARGEST LOAD:             1000.00 KVA
CONVERGENCE CRITERIA:         .050 KVA
LARGEST BUS MISMATCH      10   GEN G1              94.178 KVA
LARGEST BUS MISMATCH      10   GEN G1               2.094 KVA
LARGEST BUS MISMATCH      10   GEN G1                .047 KVA
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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (SWING GENERATORS)
****

BUS	VOLTS(PU)	ANGLE	KW	KVAR	VD%	R + JX (PU)
80	1.000	.00	-61.0	320.0	.0	

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (PV GENERATOR SCHEDULE REPORT)
****

		---VOLTAGE---		-KVAR LIMITS-		---ACTUAL----	
BUS NAME	ID	SCHED.	ACTUAL	MIN	MAX	KW	KVAR
10 GEN G1	1	1.000	1.046	.0	.0	1000.0	.0
20 GEN G2	2	1.000	1.046	.0	.0	.0	.0
30 GEN G3	3	1.000	1.046	.0	.0	.0	.0
40 GEN G4	4	1.000	1.046	.0	.0	.0	.0
50 GEN G5	5	1.000	1.046	.0	.0	.0	.0

```
CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

                   BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:   10 GEN G1      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2510 %VD: -4.6
======================== PU BUS VOLTAGE:  1.046        ANGLE:     .1 DEGREES
               ** PV TYPE GENERATOR:    1     1000.0 KW        .0 KVAR

LOAD   TO:   60 SWGR S         FEEDER AMPS:   230 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:   1000.0 KW        .0 KVAR    1000.0 KVA  PF:1.00 UNITY
LOSSES THRU FEEDER:         .2 KW        .4 KVAR        .5 KVA


==== BUS:   20 GEN G2      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.6
======================== PU BUS VOLTAGE:  1.046        ANGLE:     .1 DEGREES
               ** PV TYPE GENERATOR:    2         .0 KW        .0 KVAR
**** NO LOAD SPECIFIED ****


==== BUS:   30 GEN G3      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.6
======================== PU BUS VOLTAGE:  1.046        ANGLE:     .1 DEGREES
               ** PV TYPE GENERATOR:    3         .0 KW        .0 KVAR
**** NO LOAD SPECIFIED ****


==== BUS:   40 GEN G4      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.6
======================== PU BUS VOLTAGE:  1.046        ANGLE:     .1 DEGREES
               ** PV TYPE GENERATOR:    4         .0 KW        .0 KVAR
**** NO LOAD SPECIFIED ****


==== BUS:   50 GEN G5      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.6
======================== PU BUS VOLTAGE:  1.046        ANGLE:     .1 DEGREES
               ** PV TYPE GENERATOR:    5         .0 KW        .0 KVAR
**** NO LOAD SPECIFIED ****


==== BUS:   60 SWGR S      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.6
======================== PU BUS VOLTAGE:  1.046        ANGLE:     .1 DEGREES

LOAD FROM:   10 GEN G1         FEEDER AMPS:   230 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:    999.8 KW       -.4 KVAR     999.8 KVA  PF:1.00 UNITY
LOSSES THRU FEEDER:         .2 KW        .4 KVAR        .5 KVA

LOAD FROM:   20 GEN G2         FEEDER AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .0 KW        .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA
```

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
****

VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

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LOAD FROM:   30 GEN G3      FEEDER AMPS:        VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:     .0 KW       .0 KVAR       .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:       .0 KW       .0 KVAR       .0 KVA

LOAD   TO:   62 SS-1 SEC    TRANSF AMPS:        VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:     .2 KW       .0 KVAR       .2 KVA  PF: .97 LAGGING
LOSSES THRU TRANSF:     .0 KW      .0 KVAR      .0 KVA

LOAD   TO:   66 SM1A BLUE   FEEDER AMPS:        VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:     .3 KW       .1 KVAR       .3 KVA  PF: .97 LAGGING
LOSSES THRU FEEDER:       .0 KW       .0 KVAR       .0 KVA

LOAD   TO:   70 SWGR N      FEEDER AMPS:    129 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:  538.1 KW   -156.0 KVAR    560.3 KVA  PF: .96 LEADING
LOSSES THRU FEEDER:       .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  100 FDR 1       FEEDER AMPS:     42 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:  171.9 KW     57.6 KVAR    181.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:       .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  200 FDR 2       FEEDER AMPS:     58 VOLTAGE DROP:   1. %VD:   .0
PROJECTED POWER FLOW:  238.7 KW     79.2 KVAR    251.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:       .1 KW       .0 KVAR       .1 KVA

LOAD FROM:  300 FDR 3       FEEDER AMPS:        VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:     .0 KW       .0 KVAR       .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:       .0 KW       .0 KVAR       .0 KVA

LOAD FROM:  400 FDR 4       FEEDER AMPS:        VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:     .0 KW       .0 KVAR       .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:       .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  500 FDR 5       FEEDER AMPS:     12 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:   50.6 KW     18.7 KVAR     53.9 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:       .0 KW       .0 KVAR       .0 KVA
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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
********************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:   62 SS-1 SEC   DESIGN VOLTAGE:   480  BUS VOLTAGE:   502 %VD: -4.6
======================== PU BUS VOLTAGE:  1.046       ANGLE:     .1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:   64 MCC 4&5    DESIGN VOLTAGE:   480  BUS VOLTAGE:   502 %VD: -4.6
======================== PU BUS VOLTAGE:  1.046       ANGLE:     .1 DEGREES

LOAD FROM:   62 SS-1 SEC     FEEDER AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:         .2 KW       .0 KVAR         .2 KVA  PF: .97 LAGGING
LOSSES THRU FEEDER:           .0 KW       .0 KVAR         .0 KVA

LOAD FROM:   68 BLUE SSS     FEEDER AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:         .3 KW       .1 KVAR         .3 KVA  PF: .97 LAGGING
LOSSES THRU FEEDER:           .0 KW       .0 KVAR         .0 KVA

LOAD   TO:   90 SWGR O       TRANSF AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:         .5 KW       .1 KVAR         .5 KVA  PF: .97 LAGGING
LOSSES THRU TRANSF:      .0 KW      .0 KVAR       .0 KVA


==== BUS:   66 SM1A BLUE  DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.6
======================== PU BUS VOLTAGE:  1.046       ANGLE:     .1 DEGREES

LOAD FROM:   60 SWGR S       FEEDER AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:         .3 KW       .1 KVAR         .3 KVA  PF: .97 LAGGING
LOSSES THRU FEEDER:           .0 KW       .0 KVAR         .0 KVA

LOAD   TO:   68 BLUE SSS     TRANSF AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:         .3 KW       .1 KVAR         .3 KVA  PF: .97 LAGGING
LOSSES THRU TRANSF:      .0 KW      .0 KVAR       .0 KVA


==== BUS:   68 BLUE SSS   DESIGN VOLTAGE:   480  BUS VOLTAGE:   502 %VD: -4.6
======================== PU BUS VOLTAGE:  1.046       ANGLE:     .1 DEGREES

LOAD   TO:   64 MCC 4&5      FEEDER AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:         .3 KW       .1 KVAR         .3 KVA  PF: .97 LAGGING
LOSSES THRU FEEDER:           .0 KW       .0 KVAR         .0 KVA

LOAD FROM:   66 SM1A BLUE    TRANSF AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:         .3 KW       .1 KVAR         .3 KVA  PF: .97 LAGGING
LOSSES THRU TRANSF:      .0 KW      .0 KVAR       .0 KVA
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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:   70 SWGR N     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.6
========================= PU BUS VOLTAGE:  1.046       ANGLE:     .1 DEGREES

LOAD FROM:   40 GEN G4      FEEDER AMPS:        VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:          .0 KW         .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:            .0 KW         .0 KVAR        .0 KVA

LOAD FROM:   50 GEN G5      FEEDER AMPS:        VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:          .0 KW         .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:            .0 KW         .0 KVAR        .0 KVA

LOAD FROM:   60 SWGR S      FEEDER AMPS:   129 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      538.1 KW     -156.1 KVAR     560.3 KVA  PF: .96 LEADING
LOSSES THRU FEEDER:            .0 KW         .0 KVAR        .0 KVA

LOAD   TO:   90 SWGR O      FEEDER AMPS:   129 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      538.1 KW     -156.1 KVAR     560.3 KVA  PF: .96 LEADING
LOSSES THRU FEEDER:            .0 KW         .0 KVAR        .0 KVA


==== BUS:   80 UTILITY    DESIGN VOLTAGE: 24900  BUS VOLTAGE: 24900 %VD:    .0
========================= PU BUS VOLTAGE:  1.000       ANGLE:     .0 DEGREES
                 *** SWING  GENERATOR:    6        -61.0 KW       320.0 KVAR

LOAD FROM:   85 T1 SEC      TRANSF AMPS:     8 VOLTAGE DROP: 1134. %VD:  4.6$
PROJECTED POWER FLOW:       61.0 KW     -320.0 KVAR     325.8 KVA  PF: .19 LEADING
LOSSES THRU TRANSF:         .2 KW      2.3 KVAR      2.3 KVA **XFMR TAPS  -5.0%**


==== BUS:   85 T1 SEC     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.6
========================= PU BUS VOLTAGE:  1.046       ANGLE:     .1 DEGREES

LOAD   TO:   80 UTILITY     TRANSF AMPS:    74 VOLTAGE DROP:  109. %VD:  4.6$
PROJECTED POWER FLOW:       61.2 KW     -317.7 KVAR     323.6 KVA  PF: .19 LEADING
LOSSES THRU TRANSF:         .2 KW      2.3 KVAR      2.3 KVA **XFMR TAPS  -5.0%**

LOAD FROM:   90 SWGR O      FEEDER AMPS:    74 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:       61.2 KW     -317.7 KVAR     323.6 KVA  PF: .19 LEADING
LOSSES THRU FEEDER:            .0 KW         .0 KVAR        .0 KVA
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:   90 SWGR O     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.6
======================== PU BUS VOLTAGE:  1.046        ANGLE:     .1 DEGREES

LOAD FROM:   64 MCC 4&5     TRANSF AMPS:        VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:        .5 KW       .1 KVAR        .5 KVA  PF: .97 LAGGING
LOSSES THRU TRANSF:      .0 KW      .0 KVAR       .0 KVA

LOAD FROM:   70 SWGR N      FEEDER AMPS:   129 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:    538.1 KW   -156.1 KVAR    560.3 KVA  PF: .96 LEADING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD    TO:   85 T1 SEC     FEEDER AMPS:    74 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:     61.2 KW   -317.7 KVAR    323.6 KVA  PF: .19 LEADING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD FROM:  600 O/H BUS     FEEDER AMPS:       VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:       .0 KW       .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD    TO:  700 FDR 7      FEEDER AMPS:    52 VOLTAGE DROP:   1. %VD:   .0
PROJECTED POWER FLOW:    212.6 KW     70.6 KVAR    224.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD FROM:  800 FDR 8       FEEDER AMPS:       VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:       .0 KW       .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD    TO:  900 FDR 9      FEEDER AMPS:    64 VOLTAGE DROP:   1. %VD:   .0
PROJECTED POWER FLOW:    264.8 KW     91.1 KVAR    280.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .0 KVAR        .1 KVA


==== BUS:  100 FDR 1      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045        ANGLE:     .1 DEGREES

LOAD FROM:   60 SWGR S      FEEDER AMPS:    42 VOLTAGE DROP:   0. %VD:   .0
PROJECTED POWER FLOW:    171.8 KW     57.6 KVAR    181.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD    TO:  105 F1F12 14   FEEDER AMPS:    42 VOLTAGE DROP:  13. %VD:   .6
PROJECTED POWER FLOW:    171.8 KW     57.6 KVAR    181.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .7 KW       .9 KVAR       1.2 KVA
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                    BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  105 F1F12 14   DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2496 %VD: -4.0
======================== PU BUS VOLTAGE:  1.040        ANGLE:    -.1 DEGREES

LOAD FROM:  100 FDR 1         FEEDER AMPS:    42 VOLTAGE DROP:   13. %VD:   .6
PROJECTED POWER FLOW:     171.1 KW      56.7 KVAR     180.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .7 KW        .9 KVAR       1.2 KVA

LOAD   TO:  110 F1 L14        FEEDER AMPS:    42 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     171.1 KW      56.7 KVAR     180.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR        .2 KVA


==== BUS:  110 F1 L14     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2494 %VD: -3.9
======================== PU BUS VOLTAGE:  1.039        ANGLE:    -.1 DEGREES

LOAD FROM:  105 F1F12 14      FEEDER AMPS:    42 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     171.0 KW      56.5 KVAR     180.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR        .2 KVA

LOAD FROM:  115 F1 L15        FEEDER AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .0 KW        .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  120 F1 L31        FEEDER AMPS:    42 VOLTAGE DROP:    4. %VD:   .1
PROJECTED POWER FLOW:     171.0 KW      56.5 KVAR     180.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .3 KVAR        .3 KVA


==== BUS:  115 F1 L15     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2494 %VD: -3.9
======================== PU BUS VOLTAGE:  1.039        ANGLE:    -.1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  120 F1 L31     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2490 %VD: -3.8
======================== PU BUS VOLTAGE:  1.038        ANGLE:    -.2 DEGREES
            PROJECTED SPECIAL BUS LOAD:      45.8 KW       15.1 KVAR

LOAD FROM:  110 F1 L14        FEEDER AMPS:    42 VOLTAGE DROP:    4. %VD:   .1
PROJECTED POWER FLOW:     170.9 KW      56.3 KVAR     179.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .3 KVAR        .3 KVA
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD   TO:  121 F1 L63       FEEDER AMPS:    31 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:    125.0 KW      41.2 KVAR     131.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW        .2 KVAR        .2 KVA


==== BUS:  121 F1 L63     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2487 %VD: -3.6
======================== PU BUS VOLTAGE:  1.036        ANGLE:    -.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:      45.7 KW      15.0 KVAR

LOAD FROM:  120 F1 L31       FEEDER AMPS:    31 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:    124.9 KW      41.1 KVAR     131.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW        .2 KVAR        .2 KVA

LOAD   TO:  122 F1 L64       FEEDER AMPS:    19 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     79.2 KW      26.0 KVAR      83.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  122 F1 L64     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2486 %VD: -3.6
======================== PU BUS VOLTAGE:  1.036        ANGLE:    -.2 DEGREES
              PROJECTED SPECIAL BUS LOAD:      79.1 KW      26.0 KVAR

LOAD FROM:  121 F1 L63       FEEDER AMPS:    19 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     79.1 KW      26.0 KVAR      83.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  200 FDR 2      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045        ANGLE:     .1 DEGREES

LOAD FROM:   60 SWGR S       FEEDER AMPS:    58 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:    238.6 KW      79.2 KVAR     251.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW        .0 KVAR        .1 KVA

LOAD   TO:  205              FEEDER AMPS:    58 VOLTAGE DROP:    7. %VD:   .3
PROJECTED POWER FLOW:    238.6 KW      79.2 KVAR     251.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .5 KW        .7 KVAR        .9 KVA
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  205            DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2501 %VD: -4.2
======================== PU BUS VOLTAGE:  1.042         ANGLE:    .0 DEGREES

LOAD FROM:  200 FDR 2        FEEDER AMPS:    58 VOLTAGE DROP:    7. %VD:   .3
PROJECTED POWER FLOW:     238.1 KW      78.5 KVAR      250.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .5 KW        .7 KVAR         .9 KVA

LOAD   TO:  235 F5 F29       FEEDER AMPS:    58 VOLTAGE DROP:    5. %VD:   .2
PROJECTED POWER FLOW:     238.1 KW      78.5 KVAR      250.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .4 KW        .5 KVAR         .6 KVA


==== BUS:  235 F5 F29     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2496 %VD: -4.0
======================== PU BUS VOLTAGE:  1.040         ANGLE:   -.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:       47.6 KW        15.1 KVAR

LOAD FROM:  205              FEEDER AMPS:    58 VOLTAGE DROP:    5. %VD:   .2
PROJECTED POWER FLOW:     237.7 KW      78.0 KVAR      250.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .4 KW        .5 KVAR         .6 KVA

LOAD   TO:  236 F2 F211      FEEDER AMPS:    46 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     190.1 KW      62.8 KVAR      200.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .2 KVAR         .2 KVA


==== BUS:  236 F2 F211    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2494 %VD: -3.9
======================== PU BUS VOLTAGE:  1.039         ANGLE:   -.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:       95.0 KW        31.3 KVAR

LOAD FROM:  235 F5 F29       FEEDER AMPS:    46 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     190.0 KW      62.6 KVAR      200.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .2 KVAR         .2 KVA

LOAD   TO:  240 F1 F213      FEEDER AMPS:    23 VOLTAGE DROP:    1. %VD:   .1
PROJECTED POWER FLOW:      95.0 KW      31.3 KVAR      100.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR         .1 KVA
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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH = 4.00 %   BUS = 5.00

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==== BUS:  240 F1 F213     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2493 %VD: -3.9
======================== PU BUS VOLTAGE:  1.039         ANGLE:   -.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:       94.9 KW      31.3 KVAR

LOAD FROM:  236 F2 F211      FEEDER AMPS:    23 VOLTAGE DROP:    1. %VD:   .1
PROJECTED POWER FLOW:      94.9 KW     31.3 KVAR     100.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .1 KVA

==== BUS:  300 FDR 3       DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.6
======================== PU BUS VOLTAGE:  1.046         ANGLE:    .1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS:  400 FDR 4       DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.6
======================== PU BUS VOLTAGE:  1.046         ANGLE:    .1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS:  500 FDR 5       DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.6
======================== PU BUS VOLTAGE:  1.046         ANGLE:    .1 DEGREES

LOAD FROM:   60 SWGR S       FEEDER AMPS:    12 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      50.6 KW     18.7 KVAR      53.9 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  505 F4 F5 F6UF   FEEDER AMPS:    12 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:      50.6 KW     18.7 KVAR      53.9 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

==== BUS:  505 F4 F5 F6UF DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2508 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045         ANGLE:    .1 DEGREES

LOAD FROM:  500 FDR 5        FEEDER AMPS:    12 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:      50.5 KW     18.6 KVAR      53.9 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  512 5-3 PRI      FEEDER AMPS:    12 VOLTAGE DROP:    4. %VD:   .2
PROJECTED POWER FLOW:      50.5 KW     18.6 KVAR      53.9 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .1 KW       .1 KVAR        .1 KVA
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  512 5-3 PRI    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2503 %VD: -4.3
======================== PU BUS VOLTAGE:  1.043        ANGLE:    .0 DEGREES

LOAD FROM:  505 F4 F5 F6UF   FEEDER AMPS:    12 VOLTAGE DROP:    4. %VD:    .2
PROJECTED POWER FLOW:     50.5 KW     18.5 KVAR     53.8 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR       .1 KVA

LOAD   TO:  515 F5 L24       FEEDER AMPS:    12 VOLTAGE DROP:    3. %VD:    .1
PROJECTED POWER FLOW:     50.5 KW     18.5 KVAR     53.8 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .1 KVAR       .1 KVA


==== BUS:  515 F5 L24     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2500 %VD: -4.2
======================== PU BUS VOLTAGE:  1.042        ANGLE:    .0 DEGREES

LOAD FROM:  512 5-3 PRI      FEEDER AMPS:    12 VOLTAGE DROP:    3. %VD:    .1
PROJECTED POWER FLOW:     50.4 KW     18.5 KVAR     53.7 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .1 KVAR       .1 KVA

LOAD   TO:  525 F5 L31       FEEDER AMPS:    12 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     50.4 KW     18.5 KVAR     53.7 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  525 F5 L31     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2499 %VD: -4.1
======================== PU BUS VOLTAGE:  1.041        ANGLE:    .0 DEGREES
              PROJECTED SPECIAL BUS LOAD:       8.7 KW      3.6 KVAR

LOAD FROM:  515 F5 L24       FEEDER AMPS:    12 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     50.4 KW     18.5 KVAR     53.7 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  531 F3 L41       FEEDER AMPS:     5 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     20.9 KW      7.5 KVAR     22.2 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  535 F537 L5      FEEDER AMPS:     5 VOLTAGE DROP:    2. %VD:    .1
PROJECTED POWER FLOW:     20.9 KW      7.5 KVAR     22.2 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA
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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  531 F3 L41     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2499 %VD: -4.1
======================== PU BUS VOLTAGE:  1.041        ANGLE:    .0 DEGREES

LOAD FROM:  525 F5 L31       FEEDER AMPS:      5 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     20.9 KW       7.4 KVAR      22.1 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  535 F537 L5      FEEDER AMPS:      5 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     20.9 KW       7.4 KVAR      22.1 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  535 F537 L5    DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2498 %VD: -4.1
======================== PU BUS VOLTAGE:  1.041        ANGLE:   -.1 DEGREES

LOAD FROM:  525 F5 L31       FEEDER AMPS:      5 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     20.9 KW       7.4 KVAR      22.1 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD FROM:  531 F3 L41       FEEDER AMPS:      5 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     20.9 KW       7.4 KVAR      22.1 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  555              FEEDER AMPS:     10 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     41.7 KW      14.9 KVAR      44.3 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  555            DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2495 %VD: -4.0
======================== PU BUS VOLTAGE:  1.040        ANGLE:   -.1 DEGREES

LOAD FROM:  535 F537 L5      FEEDER AMPS:     10 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     41.7 KW      14.9 KVAR      44.2 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  560 RICH SUB     FEEDER AMPS:      7 VOLTAGE DROP:    6. %VD:   .3
PROJECTED POWER FLOW:     27.6 KW       9.2 KVAR      29.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW        .1 KVAR        .1 KVA

LOAD   TO:  565 5-17 PRI     FEEDER AMPS:      4 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     14.0 KW       5.7 KVAR      15.1 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA
```

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

```
                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  560 RICH SUB   DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2489 %VD: -3.7
========================= PU BUS VOLTAGE:  1.037       ANGLE:   -.1 DEGREES

LOAD FROM:  555             FEEDER AMPS:     7 VOLTAGE DROP:    6. %VD:   .3
PROJECTED POWER FLOW:     27.6 KW      9.1 KVAR      29.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW       .1 KVAR        .1 KVA

LOAD   TO:  562 RS SEC      TRANSF AMPS:     7 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:     27.6 KW      9.1 KVAR      29.0 KVA  PF: .95 LAGGING
LOSSES THRU TRANSF:      .0 KW      .1 KVAR      .1 KVA


==== BUS:  562 RS SEC     DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7458 %VD: -3.6
========================= PU BUS VOLTAGE:  1.036       ANGLE:   -.3 DEGREES

LOAD FROM:  560 RICH SUB    TRANSF AMPS:     2 VOLTAGE DROP:    9. %VD:   .1
PROJECTED POWER FLOW:     27.5 KW      9.1 KVAR      29.0 KVA  PF: .95 LAGGING
LOSSES THRU TRANSF:      .0 KW      .1 KVAR      .1 KVA

LOAD   TO:  930 RICH SUB    FEEDER AMPS:     2 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     27.5 KW      9.1 KVAR      29.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA


==== BUS:  565 5-17 PRI   DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2495 %VD: -3.9
========================= PU BUS VOLTAGE:  1.039       ANGLE:   -.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:        5.4 KW       2.1 KVAR

LOAD FROM:  555             FEEDER AMPS:     4 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     14.0 KW      5.7 KVAR      15.1 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  575 F5 51       FEEDER AMPS:     2 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      8.6 KW      3.5 KVAR       9.3 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA
```

```
CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  575 F5 51       DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2494 %VD: -3.9
========================= PU BUS VOLTAGE:  1.039        ANGLE:    -.1 DEGREES

LOAD FROM:  565 5-17 PRI     FEEDER AMPS:      2 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:       8.6 KW      3.5 KVAR       9.3 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  580 F5 L85       FEEDER AMPS:      2 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:       8.6 KW      3.5 KVAR       9.3 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA


==== BUS:  580 F5 L85      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2494 %VD: -3.9
========================= PU BUS VOLTAGE:  1.039        ANGLE:    -.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:       8.6 KW       3.5 KVAR

LOAD FROM:  575 F5 51        FEEDER AMPS:      2 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:       8.6 KW      3.5 KVAR       9.3 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA


==== BUS:  600 O/H BUS     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.6
========================= PU BUS VOLTAGE:  1.046        ANGLE:     .1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  700 FDR 7       DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.5
========================= PU BUS VOLTAGE:  1.045        ANGLE:     .1 DEGREES

LOAD FROM:   90 SWGR O       FEEDER AMPS:     52 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     212.6 KW     70.6 KVAR     224.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  705 WELL9 POL    FEEDER AMPS:     52 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     212.6 KW     70.6 KVAR     224.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .1 KVA
```

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                    BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  705 WELL9 POL  DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2508 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045        ANGLE:     .1 DEGREES
                PROJECTED SPECIAL BUS LOAD:     44.8 KW      15.3 KVAR

LOAD FROM:  700 FDR 7        FEEDER AMPS:    52 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     212.5 KW      70.6 KVAR    223.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .1 KVA

LOAD FROM:  707 7-1 SEC      TRANSF AMPS:        VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:        .0 KW        .0 KVAR       .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:       .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  709 F9 F73       FEEDER AMPS:    41 VOLTAGE DROP:    2. %VD:    .1
PROJECTED POWER FLOW:     167.8 KW      55.3 KVAR    176.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR       .1 KVA


==== BUS:  707 7-1 SEC    DESIGN VOLTAGE:   480  BUS VOLTAGE:   502 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045        ANGLE:     .1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  709 F9 F73     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2506 %VD: -4.4
======================== PU BUS VOLTAGE:  1.044        ANGLE:     .1 DEGREES
                PROJECTED SPECIAL BUS LOAD:     90.5 KW      29.4 KVAR

LOAD FROM:  705 WELL9 POL    FEEDER AMPS:    41 VOLTAGE DROP:    2. %VD:    .1
PROJECTED POWER FLOW:     167.7 KW      55.2 KVAR    176.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR       .1 KVA

LOAD   TO:  710 F7 L11       FEEDER AMPS:    19 VOLTAGE DROP:    4. %VD:    .2
PROJECTED POWER FLOW:      77.1 KW      25.7 KVAR     81.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR       .2 KVA


==== BUS:  710 F7 L11     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2502 %VD: -4.3
======================== PU BUS VOLTAGE:  1.043        ANGLE:     .0 DEGREES
                PROJECTED SPECIAL BUS LOAD:     22.5 KW       7.4 KVAR

LOAD FROM:  709 F9 F73       FEEDER AMPS:    19 VOLTAGE DROP:    4. %VD:    .2
PROJECTED POWER FLOW:      77.0 KW      25.6 KVAR     81.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR       .2 KVA
```

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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              BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD    TO:  715 F7 L13     FEEDER AMPS:     6 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     22.8 KW       7.6 KVAR      24.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD    TO:  720 F713       FEEDER AMPS:     8 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     31.8 KW      10.6 KVAR      33.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  715 F7 L13     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2502 %VD: -4.2
======================== PU BUS VOLTAGE:  1.042        ANGLE:     .0 DEGREES
              PROJECTED SPECIAL BUS LOAD:      22.8 KW      7.6 KVAR

LOAD FROM:  710 F7 L11      FEEDER AMPS:     6 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     22.8 KW       7.6 KVAR      24.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  720 F713       DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2502 %VD: -4.2
======================== PU BUS VOLTAGE:  1.042        ANGLE:     .0 DEGREES

LOAD FROM:  710 F7 L11      FEEDER AMPS:     8 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     31.7 KW      10.6 KVAR      33.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD    TO:  725 7-15 PRI   FEEDER AMPS:     8 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     31.7 KW      10.6 KVAR      33.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  725 7-15 PRI   DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2500 %VD: -4.2
======================== PU BUS VOLTAGE:  1.042        ANGLE:     .0 DEGREES

LOAD FROM:  720 F713        FEEDER AMPS:     8 VOLTAGE DROP:    2. %VD:   .1
PROJECTED POWER FLOW:     31.7 KW      10.6 KVAR      33.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD    TO:  735 F7 L54     FEEDER AMPS:     8 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     31.7 KW      10.6 KVAR      33.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA
```

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  735 F7 L54     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2499 %VD: -4.1
======================== PU BUS VOLTAGE:  1.041        ANGLE:    .0 DEGREES
              PROJECTED SPECIAL BUS LOAD:       9.0 KW       2.9 KVAR

LOAD FROM:  725 7-15 PRI     FEEDER AMPS:     8 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     31.7 KW      10.5 KVAR     33.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR       .0 KVA

LOAD    TO:  745         FEEDER AMPS:     6 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     22.8 KW       7.6 KVAR     24.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR       .0 KVA


==== BUS:  745            DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2498 %VD: -4.1
======================== PU BUS VOLTAGE:  1.041        ANGLE:   -.1 DEGREES

LOAD FROM:  735 F7 L54      FEEDER AMPS:     6 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     22.7 KW       7.6 KVAR     24.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR       .0 KVA

LOAD    TO:  750 F7 L72      FEEDER AMPS:     6 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     22.7 KW       7.6 KVAR     24.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR       .0 KVA


==== BUS:  750 F7 L72     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2498 %VD: -4.1
======================== PU BUS VOLTAGE:  1.041        ANGLE:   -.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:      22.7 KW       7.6 KVAR

LOAD FROM:  745              FEEDER AMPS:     6 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     22.7 KW       7.6 KVAR     24.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR       .0 KVA


==== BUS:  800 FDR 8      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.6
======================== PU BUS VOLTAGE:  1.046        ANGLE:    .1 DEGREES
**** NO LOAD SPECIFIED ****
```

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

```
                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  900 FDR 9      DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2509 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045        ANGLE:    .1 DEGREES

LOAD FROM:   90 SWGR O       FEEDER AMPS:     64 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     264.7 KW      91.1 KVAR     280.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .0 KVAR        .1 KVA

LOAD   TO:  905 STEP SEC     TRANSF AMPS:     64 VOLTAGE DROP:    9. %VD:   .4
PROJECTED POWER FLOW:     264.7 KW      91.1 KVAR     280.0 KVA  PF: .95 LAGGING
LOSSES THRU TRANSF:        .4 KW     2.2 KVAR      2.2 KVA


==== BUS:  905 STEP SEC   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7498 %VD: -4.1
======================== PU BUS VOLTAGE:  1.041        ANGLE:   -.3 DEGREES

LOAD FROM:  900 FDR 9        TRANSF AMPS:     21 VOLTAGE DROP:   28. %VD:   .4
PROJECTED POWER FLOW:     264.3 KW      88.9 KVAR     278.9 KVA  PF: .95 LAGGING
LOSSES THRU TRANSF:        .4 KW     2.2 KVAR      2.2 KVA

LOAD   TO:  910 F 96         FEEDER AMPS:     21 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:     264.3 KW      88.9 KVAR     278.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR        .1 KVA


==== BUS:  910 F 96       DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7495 %VD: -4.1
======================== PU BUS VOLTAGE:  1.041        ANGLE:   -.3 DEGREES
              PROJECTED SPECIAL BUS LOAD:      19.3 KW        6.3 KVAR

LOAD FROM:  905 STEP SEC     FEEDER AMPS:     21 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:     264.3 KW      88.8 KVAR     278.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR        .1 KVA

LOAD   TO:  915 F910         FEEDER AMPS:     20 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:     245.0 KW      82.5 KVAR     258.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR        .1 KVA
```

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

```
                  BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  915 F910        DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7491 %VD: -4.0
======================== PU BUS VOLTAGE:  1.040        ANGLE:   -.3 DEGREES

LOAD FROM:  910 F 96        FEEDER AMPS:    20 VOLTAGE DROP:    3. %VD:    .0
PROJECTED POWER FLOW:     244.9 KW     82.4 KVAR     258.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .1 KVAR        .1 KVA

LOAD   TO:  920 F940        FEEDER AMPS:    20 VOLTAGE DROP:   19. %VD:    .3
PROJECTED POWER FLOW:     244.9 KW     82.4 KVAR     258.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .5 KW       .6 KVAR        .8 KVA


==== BUS:  920 F940        DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7472 %VD: -3.8
======================== PU BUS VOLTAGE:  1.038        ANGLE:   -.4 DEGREES

LOAD FROM:  915 F910        FEEDER AMPS:    20 VOLTAGE DROP:   19. %VD:    .3
PROJECTED POWER FLOW:     244.4 KW     81.7 KVAR     257.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .5 KW       .6 KVAR        .8 KVA

LOAD   TO:  945 F949 L1     FEEDER AMPS:    20 VOLTAGE DROP:    3. %VD:    .0
PROJECTED POWER FLOW:     244.4 KW     81.7 KVAR     257.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .1 KVAR        .1 KVA


==== BUS:  925 ()          DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7455 %VD: -3.5
======================== PU BUS VOLTAGE:  1.035        ANGLE:   -.3 DEGREES

LOAD FROM:  930 RICH SUB    FEEDER AMPS:     2 VOLTAGE DROP:    3. %VD:    .0
PROJECTED POWER FLOW:      27.5 KW      9.0 KVAR      29.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  935 9-8 PRI     FEEDER AMPS:     2 VOLTAGE DROP:    3. %VD:    .0
PROJECTED POWER FLOW:      27.5 KW      9.0 KVAR      29.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA


==== BUS:  930 RICH SUB    DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7458 %VD: -3.6
======================== PU BUS VOLTAGE:  1.036        ANGLE:   -.3 DEGREES

LOAD FROM:  562 RS SEC      FEEDER AMPS:     2 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      27.5 KW      9.1 KVAR      29.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA
```

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

```
               BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
***************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD   TO:  925 ()          FEEDER AMPS:     2 VOLTAGE DROP:    3. %VD:    .0
PROJECTED POWER FLOW:     27.5 KW       9.1 KVAR      29.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  935 9-8 PRI    DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7453 %VD: -3.5
======================== PU BUS VOLTAGE:  1.035        ANGLE:   -.3 DEGREES
             PROJECTED SPECIAL BUS LOAD:      11.0 KW       3.6 KVAR

LOAD FROM:  925 ()          FEEDER AMPS:     2 VOLTAGE DROP:    3. %VD:    .0
PROJECTED POWER FLOW:     27.5 KW       9.0 KVAR      29.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  940 9-9 PRI     FEEDER AMPS:     1 VOLTAGE DROP:    8. %VD:    .1
PROJECTED POWER FLOW:     16.5 KW       5.4 KVAR      17.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  940 9-9 PRI    DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7444 %VD: -3.4
======================== PU BUS VOLTAGE:  1.034        ANGLE:   -.3 DEGREES
             PROJECTED SPECIAL BUS LOAD:      16.5 KW       5.4 KVAR

LOAD FROM:  935 9-8 PRI     FEEDER AMPS:     1 VOLTAGE DROP:    8. %VD:    .1
PROJECTED POWER FLOW:     16.5 KW       5.4 KVAR      17.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  945 F949 L1    DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7469 %VD: -3.7
======================== PU BUS VOLTAGE:  1.037        ANGLE:   -.4 DEGREES
             PROJECTED SPECIAL BUS LOAD:       4.7 KW       1.5 KVAR

LOAD FROM:  920 F940        FEEDER AMPS:    20 VOLTAGE DROP:    3. %VD:    .0
PROJECTED POWER FLOW:    244.3 KW      81.6 KVAR     257.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW        .1 KVAR        .1 KVA

LOAD   TO:  960 9-13 PRI    FEEDER AMPS:    20 VOLTAGE DROP:   23. %VD:    .3
PROJECTED POWER FLOW:    239.6 KW      80.1 KVAR     252.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .7 KW        .3 KVAR        .8 KVA
```

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

```
                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  960 9-13 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7446 %VD: -3.4
======================== PU BUS VOLTAGE:  1.034       ANGLE:   -.5 DEGREES

LOAD FROM:  945 F949 L1      FEEDER AMPS:    20 VOLTAGE DROP:   23. %VD:    .3
PROJECTED POWER FLOW:     238.9 KW      79.8 KVAR     251.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .7 KW        .3 KVAR        .8 KVA

LOAD   TO:  963 9-14 PRI     FEEDER AMPS:    20 VOLTAGE DROP:   78. %VD:   1.1
PROJECTED POWER FLOW:     238.9 KW      79.8 KVAR     251.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         2.4 KW       1.1 KVAR       2.7 KVA


==== BUS:  963 9-14 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7368 %VD: -2.3
======================== PU BUS VOLTAGE:  1.023       ANGLE:   -.5 DEGREES
              PROJECTED SPECIAL BUS LOAD:     18.7 KW      6.1 KVAR

LOAD FROM:  960 9-13 PRI     FEEDER AMPS:    20 VOLTAGE DROP:   78. %VD:   1.1
PROJECTED POWER FLOW:     236.5 KW      78.6 KVAR     249.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         2.4 KW       1.1 KVAR       2.7 KVA

LOAD   TO:  966 9-15 PRI     FEEDER AMPS:    18 VOLTAGE DROP:   21. %VD:    .3
PROJECTED POWER FLOW:     217.9 KW      72.5 KVAR     229.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .6 KW        .3 KVAR        .7 KVA


==== BUS:  966 9-15 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7347 %VD: -2.0
======================== PU BUS VOLTAGE:  1.020       ANGLE:   -.6 DEGREES

LOAD FROM:  963 9-14 PRI     FEEDER AMPS:    18 VOLTAGE DROP:   21. %VD:    .3
PROJECTED POWER FLOW:     217.3 KW      72.2 KVAR     229.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .6 KW        .3 KVAR        .7 KVA

LOAD   TO:  969 SW UP        FEEDER AMPS:    18 VOLTAGE DROP:    6. %VD:    .1
PROJECTED POWER FLOW:     217.3 KW      72.2 KVAR     229.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .1 KVAR        .2 KVA
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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  969 SW UP      DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7342 %VD: -2.0
======================== PU BUS VOLTAGE:  1.020       ANGLE:   -.6 DEGREES

LOAD FROM:  966 9-15 PRI     FEEDER AMPS:    18 VOLTAGE DROP:    6. %VD:   .1
PROJECTED POWER FLOW:    217.1 KW      72.1 KVAR    228.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .2 KW        .1 KVAR       .2 KVA

LOAD   TO:  972 SW DOWN      FEEDER AMPS:    18 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:    217.1 KW      72.1 KVAR    228.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR       .0 KVA


==== BUS:  972 SW DOWN    DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7342 %VD: -2.0
======================== PU BUS VOLTAGE:  1.020       ANGLE:   -.6 DEGREES

LOAD FROM:  969 SW UP        FEEDER AMPS:    18 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:    217.1 KW      72.1 KVAR    228.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR       .0 KVA

LOAD   TO:  975 9-16 PRI     FEEDER AMPS:    18 VOLTAGE DROP:   79. %VD:  1.1
PROJECTED POWER FLOW:    217.1 KW      72.1 KVAR    228.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:        2.3 KW       1.1 KVAR      2.5 KVA


==== BUS:  975 9-16 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7262 %VD:  -.9
======================== PU BUS VOLTAGE:  1.009       ANGLE:   -.6 DEGREES

LOAD FROM:  972 SW DOWN      FEEDER AMPS:    18 VOLTAGE DROP:   79. %VD:  1.1
PROJECTED POWER FLOW:    214.9 KW      71.0 KVAR    226.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:        2.3 KW       1.1 KVAR      2.5 KVA

LOAD   TO:  980              FEEDER AMPS:    18 VOLTAGE DROP:   33. %VD:   .5
PROJECTED POWER FLOW:    214.9 KW      71.0 KVAR    226.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .9 KW        .4 KVAR      1.0 KVA


==== BUS:  980            DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7229 %VD:  -.4
======================== PU BUS VOLTAGE:  1.004       ANGLE:   -.7 DEGREES

LOAD FROM:  975 9-16 PRI     FEEDER AMPS:    18 VOLTAGE DROP:   33. %VD:   .5
PROJECTED POWER FLOW:    213.9 KW      70.6 KVAR    225.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .9 KW        .4 KVAR      1.0 KVA
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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
********************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD    TO:  983 9-25 PRI     FEEDER AMPS:    18 VOLTAGE DROP:   57. %VD:   .8
PROJECTED POWER FLOW:     213.9 KW     70.6 KVAR    225.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         1.6 KW       .8 KVAR      1.8 KVA


==== BUS:  983 9-25 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7172 %VD:   .4
========================= PU BUS VOLTAGE:   .996        ANGLE:   -.7 DEGREES
              PROJECTED SPECIAL BUS LOAD:    155.3 KW     51.0 KVAR

LOAD FROM:  980               FEEDER AMPS:    18 VOLTAGE DROP:   57. %VD:   .8
PROJECTED POWER FLOW:     212.3 KW     69.8 KVAR    223.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         1.6 KW       .8 KVAR      1.8 KVA

LOAD    TO:  984 9-25 SEC     TRANSF AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .0 KW       .0 KVAR       .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:      .0 KW     .0 KVAR      .0 KVA

LOAD    TO:  985 9-34 PRI     FEEDER AMPS:     5 VOLTAGE DROP:    5. %VD:   .1
PROJECTED POWER FLOW:      57.0 KW     18.8 KVAR     60.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA


==== BUS:  984 9-25 SEC   DESIGN VOLTAGE:   208  BUS VOLTAGE:   207 %VD:   .4
========================= PU BUS VOLTAGE:   .996        ANGLE:   -.7 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  985 9-34 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7167 %VD:   .5
========================= PU BUS VOLTAGE:   .995        ANGLE:   -.7 DEGREES

LOAD FROM:  983 9-25 PRI      FEEDER AMPS:     5 VOLTAGE DROP:    5. %VD:   .1
PROJECTED POWER FLOW:      57.0 KW     18.8 KVAR     60.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA

LOAD    TO:  987              FEEDER AMPS:     5 VOLTAGE DROP:   16. %VD:   .2
PROJECTED POWER FLOW:      57.0 KW     18.8 KVAR     60.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .1 KVAR       .1 KVA
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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  987             DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7151 %VD:    .7
========================== PU BUS VOLTAGE:    .993        ANGLE:   -.8 DEGREES

LOAD FROM:  985 9-34 PRI     FEEDER AMPS:      5 VOLTAGE DROP:   16. %VD:    .2
PROJECTED POWER FLOW:     56.8 KW      18.7 KVAR      59.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW        .1 KVAR        .1 KVA

LOAD   TO:  990 9-26 PRI     FEEDER AMPS:      3 VOLTAGE DROP:   15. %VD:    .2
PROJECTED POWER FLOW:     33.3 KW      11.0 KVAR      35.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW        .0 KVAR        .1 KVA

LOAD   TO:  992              FEEDER AMPS:      2 VOLTAGE DROP:   28. %VD:    .4
PROJECTED POWER FLOW:     23.5 KW       7.8 KVAR      24.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW        .0 KVAR        .1 KVA


==== BUS:  990 9-26 PRI    DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7136 %VD:    .9
========================== PU BUS VOLTAGE:    .991        ANGLE:   -.8 DEGREES
               PROJECTED SPECIAL BUS LOAD:     33.2 KW      10.9 KVAR

LOAD FROM:  987              FEEDER AMPS:      3 VOLTAGE DROP:   15. %VD:    .2
PROJECTED POWER FLOW:     33.2 KW      10.9 KVAR      35.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW        .0 KVAR        .1 KVA


==== BUS:  992             DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7123 %VD:   1.1
========================== PU BUS VOLTAGE:    .989        ANGLE:   -.8 DEGREES

LOAD FROM:  987              FEEDER AMPS:      2 VOLTAGE DROP:   28. %VD:    .4
PROJECTED POWER FLOW:     23.4 KW       7.7 KVAR      24.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .1 KW        .0 KVAR        .1 KVA

LOAD   TO:  997 9-32 PRI     FEEDER AMPS:      2 VOLTAGE DROP:    5. %VD:    .1
PROJECTED POWER FLOW:     23.4 KW       7.7 KVAR      24.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA
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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

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******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  997 9-32 PRI   DESIGN VOLTAGE:  7200  BUS VOLTAGE:  7117 %VD:  1.1
======================== PU BUS VOLTAGE:   .989        ANGLE:   -.8 DEGREES
              PROJECTED SPECIAL BUS LOAD:     23.4 KW       7.7 KVAR

LOAD FROM:  992            FEEDER AMPS:     2 VOLTAGE DROP:    5. %VD:   .1
PROJECTED POWER FLOW:      23.4 KW      7.7 KVAR      24.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA
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BALANCED VOLTAGE DROP AND LOAD FLOW BUS DATA SUMMARY
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BUS#	NAME	BASE VOLT	PU VOLT	BUS#	NAME	BASE VOLT	PU VOLT
10	GEN G1	2400.00	1.046	20	GEN G2	2400.00	1.046
30	GEN G3	2400.00	1.046	40	GEN G4	2400.00	1.046
50	GEN G5	2400.00	1.046	60	SWGR S	2400.00	1.046
62	SS-1 SEC	480.00	1.046	64	MCC 4&5	480.00	1.046
66	SM1A BLUE	2400.00	1.046	68	BLUE SSS	480.00	1.046
70	SWGR N	2400.00	1.046	80	UTILITY	24900.00	1.000
85	T1 SEC	2400.00	1.046	90	SWGR O	2400.00	1.046
100	FDR 1	2400.00	1.045	105	F1F12 14	2400.00	1.040
110	F1 L14	2400.00	1.039	115	F1 L15	2400.00	1.039
120	F1 L31	2400.00	1.038	121	F1 L63	2400.00	1.036
122	F1 L64	2400.00	1.036	200	FDR 2	2400.00	1.045
205		2400.00	1.042	235	F5 F29	2400.00	1.040
236	F2 F211	2400.00	1.039	240	F1 F213	2400.00	1.039
300	FDR 3	2400.00	1.046	400	FDR 4	2400.00	1.046
500	FDR 5	2400.00	1.046	505	F4 F5 F6UF	2400.00	1.045
512	5-3 PRI	2400.00	1.043	515	F5 L24	2400.00	1.042
525	F5 L31	2400.00	1.041	531	F3 L41	2400.00	1.041
535	F537 L5	2400.00	1.041	555		2400.00	1.040
560	RICH SUB	2400.00	1.037	562	RS SEC	7200.00	1.036
565	5-17 PRI	2400.00	1.039	575	F5 51	2400.00	1.039
580	F5 L85	2400.00	1.039	600	O/H BUS	2400.00	1.046
700	FDR 7	2400.00	1.045	705	WELL9 POL	2400.00	1.045
707	7-1 SEC	480.00	1.045	709	F9 F73	2400.00	1.044
710	F7 L11	2400.00	1.043	715	F7 L13	2400.00	1.042
720	F713	2400.00	1.042	725	7-15 PRI	2400.00	1.042
735	F7 L54	2400.00	1.041	745		2400.00	1.041
750	F7 L72	2400.00	1.041	800	FDR 8	2400.00	1.046
900	FDR 9	2400.00	1.045	905	STEP SEC	7200.00	1.041
910	F 96	7200.00	1.041	915	F910	7200.00	1.040
920	F940	7200.00	1.038	925	()	7200.00	1.035
930	RICH SUB	7200.00	1.036	935	9-8 PRI	7200.00	1.035
940	9-9 PRI	7200.00	1.034	945	F949 L1	7200.00	1.037
960	9-13 PRI	7200.00	1.034	963	9-14 PRI	7200.00	1.023
966	9-15 PRI	7200.00	1.020	969	SW UP	7200.00	1.020
972	SW DOWN	7200.00	1.020	975	9-16 PRI	7200.00	1.009
980		7200.00	1.004	983	9-25 PRI	7200.00	.996
984	9-25 SEC	208.00	.996	985	9-34 PRI	7200.00	.995
987		7200.00	.993	990	9-26 PRI	7200.00	.991
992		7200.00	.989	997	9-32 PRI	7200.00	.989

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
10	GEN G1	60	SWGR S	FDR	.02	230.03	1000.00	49.47
20	GEN G2	60	SWGR S	FDR	.00	.00	.00	.00
30	GEN G3	60	SWGR S	FDR	.00	.00	.00	.00
40	GEN G4	70	SWGR N	FDR	.00	.00	.00	.00
50	GEN G5	70	SWGR N	FDR	.00	.00	.00	.00
60	SWGR S	10	GEN G1	FDR	.02	230.03	999.76	49.47
60	SWGR S	20	GEN G2	FDR	.00	.00	.00	.00
60	SWGR S	30	GEN G3	FDR	.00	.00	.00	.00
60	SWGR S	62	SS-1 SEC	TX2	.00	.05	.20	UNKNOW
60	SWGR S	66	SM1A BLUE	FDR	.00	.07	.31	.02
60	SWGR S	70	SWGR N	FDR	.00	128.92	560.31	27.72
60	SWGR S	100	FDR 1	FDR	.02	41.71	181.27	18.13
60	SWGR S	200	FDR 2	FDR	.02	57.87	251.50	25.16
60	SWGR S	300	FDR 3	FDR	.00	.00	.00	.00
60	SWGR S	400	FDR 4	FDR	.00	.00	.00	.00
60	SWGR S	500	FDR 5	FDR	.01	12.40	53.89	5.39
62	SS-1 SEC	60	SWGR S	TX2	.00	.23	.20	UNKNOW
62	SS-1 SEC	64	MCC 4&5	FDR	.00	.23	.20	.05
64	MCC 4&5	62	SS-1 SEC	FDR	.00	.23	.20	.05
64	MCC 4&5	68	BLUE SSS	FDR	.00	.35	.31	.08
64	MCC 4&5	90	SWGR O	TX2	.00	.59	.51	UNKNOW
66	SM1A BLUE	60	SWGR S	FDR	.00	.07	.31	.02
66	SM1A BLUE	68	BLUE SSS	TX2	.00	.07	.31	UNKNOW
68	BLUE SSS	64	MCC 4&5	FDR	.00	.35	.31	.08
68	BLUE SSS	66	SM1A BLUE	TX2	.00	.35	.31	UNKNOW
70	SWGR N	40	GEN G4	FDR	.00	.00	.00	.00
70	SWGR N	50	GEN G5	FDR	.00	.00	.00	.00
70	SWGR N	60	SWGR S	FDR	.00	128.92	560.31	27.72
70	SWGR N	90	SWGR O	FDR	.00	128.92	560.31	34.84
80	UTILITY	85	T1 SEC	TX2	4.55	7.55	325.76	UNKNOW
85	T1 SEC	80	UTILITY	TX2	4.55	74.45	323.57	UNKNOW
85	T1 SEC	90	SWGR O	FDR	.00	74.45	323.57	20.12
90	SWGR O	64	MCC 4&5	TX2	.00	.12	.51	UNKNOW
90	SWGR O	70	SWGR N	FDR	.00	128.92	560.29	34.84
90	SWGR O	85	T1 SEC	FDR	.00	74.45	323.56	20.12
90	SWGR O	600	O/H BUS	FDR	.00	.00	.00	.00
90	SWGR O	700	FDR 7	FDR	.02	51.55	224.03	22.41
90	SWGR O	800	FDR 8	FDR	.00	.00	.00	.00
90	SWGR O	900	FDR 9	FDR	.03	64.43	280.02	28.01
100	FDR 1	60	SWGR S	FDR	.02	41.71	181.24	18.13

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
100	FDR 1	105	F1F12 14	FDR	.56	41.71	181.24	11.68
105	F1F12 14	100	FDR 1	FDR	.56	41.71	180.28	11.68
105	F1F12 14	110	F1 L14	FDR	.07	41.71	180.28	11.68
110	F1 L14	105	F1F12 14	FDR	.07	41.71	180.15	11.68
110	F1 L14	115	F1 L15	FDR	.00	.00	.00	.00
110	F1 L14	120	F1 L31	FDR	.15	41.71	180.15	11.68
115	F1 L15	110	F1 L14	FDR	.00	.00	.00	.00
120	F1 L31	110	F1 L14	FDR	.15	41.71	179.89	11.68
120	F1 L31	121	F1 L63	FDR	.12	30.52	131.64	8.55
121	F1 L63	120	F1 L31	FDR	.12	30.52	131.49	8.55
121	F1 L63	122	F1 L64	FDR	.03	19.35	83.34	5.42
122	F1 L64	121	F1 L63	FDR	.03	19.35	83.32	5.42
200	FDR 2	60	SWGR S	FDR	.02	57.87	251.44	25.16
200	FDR 2	205		FDR	.31	57.87	251.44	16.21
205		200	FDR 2	FDR	.31	57.87	250.70	16.21
205		235	F5 F29	FDR	.21	57.87	250.70	16.21
235	F5 F29	205		FDR	.21	57.87	250.21	16.21
235	F5 F29	236	F2 F211	FDR	.10	46.31	200.25	12.97
236	F2 F211	235	F5 F29	FDR	.10	46.31	200.05	12.97
236	F2 F211	240	F1 F213	FDR	.05	23.15	100.00	6.48
240	F1 F213	236	F2 F211	FDR	.05	23.15	99.95	6.48
300	FDR 3	60	SWGR S	FDR	.00	.00	.00	.00
400	FDR 4	60	SWGR S	FDR	.00	.00	.00	.00
500	FDR 5	60	SWGR S	FDR	.01	12.40	53.89	5.39
500	FDR 5	505	F4 F5 F6UF	FDR	.07	12.40	53.89	3.47
505	F4 F5 F6UF	500	FDR 5	FDR	.07	12.40	53.85	3.47
505	F4 F5 F6UF	512	5-3 PRI	FDR	.18	12.40	53.85	3.47
512	5-3 PRI	505	F4 F5 F6UF	FDR	.18	12.40	53.76	3.47
512	5-3 PRI	515	F5 L24	FDR	.14	12.40	53.76	3.47
515	F5 L24	512	5-3 PRI	FDR	.14	12.40	53.69	3.47
515	F5 L24	525	F5 L31	FDR	.02	12.40	53.69	3.47
525	F5 L31	515	F5 L24	FDR	.02	12.40	53.68	3.47
525	F5 L31	531	F3 L41	FDR	.02	5.12	22.15	1.43
525	F5 L31	535	F537 L5	FDR	.06	5.12	22.15	1.43
531	F3 L41	525	F5 L31	FDR	.02	5.12	22.15	1.43
531	F3 L41	535	F537 L5	FDR	.04	5.12	22.15	1.43
535	F537 L5	525	F5 L31	FDR	.06	5.12	22.14	1.43
535	F537 L5	531	F3 L41	FDR	.04	5.12	22.14	1.43
535	F537 L5	555		FDR	.10	10.23	44.28	3.71
555		535	F537 L5	FDR	.10	10.23	44.24	3.71

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
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FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
555		560	RICH SUB	FDR	.27	6.73	29.11	2.44
555		565	5-17 PRI	FDR	.04	3.50	15.15	1.27
560	RICH SUB	555		FDR	.27	6.73	29.03	2.44
560	RICH SUB	562	RS SEC	TX2	.12	6.73	29.03	UNKNOW
562	RS SEC	560	RICH SUB	TX2	.12	2.24	29.00	UNKNOW
562	RS SEC	930	RICH SUB	FDR	.00	2.24	29.00	1.60
565	5-17 PRI	555		FDR	.04	3.50	15.14	1.27
565	5-17 PRI	575	F5 51	FDR	.01	2.16	9.34	.78
575	F5 51	565	5-17 PRI	FDR	.01	2.16	9.34	.78
575	F5 51	580	F5 L85	FDR	.02	2.16	9.34	.78
580	F5 L85	575	F5 51	FDR	.02	2.16	9.34	.78
600	O/H BUS	90	SWGR O	FDR	.00	.00	.00	.00
700	FDR 7	90	SWGR O	FDR	.02	51.55	223.99	22.41
700	FDR 7	705	WELL9 POL	FDR	.02	51.55	223.99	14.44
705	WELL9 POL	700	FDR 7	FDR	.02	51.55	223.94	14.44
705	WELL9 POL	707	7-1 SEC	TX2	.00	.00	.00	UNKNOW
705	WELL9 POL	709	F9 F73	FDR	.07	40.66	176.62	11.39
707	7-1 SEC	705	WELL9 POL	TX2	.00	.00	.00	UNKNOW
709	F9 F73	705	WELL9 POL	FDR	.07	40.66	176.50	11.39
709	F9 F73	710	F7 L11	FDR	.17	18.73	81.31	5.25
710	F7 L11	709	F9 F73	FDR	.17	18.73	81.18	5.25
710	F7 L11	715	F7 L13	FDR	.02	5.55	24.06	1.55
710	F7 L11	720	F713	FDR	.03	7.72	33.47	2.16
715	F7 L13	710	F7 L11	FDR	.02	5.55	24.05	1.55
720	F713	710	F7 L11	FDR	.03	7.72	33.46	2.16
720	F713	725	7-15 PRI	FDR	.08	7.72	33.46	2.16
725	7-15 PRI	720	F713	FDR	.08	7.72	33.44	2.16
725	7-15 PRI	735	F7 L54	FDR	.02	7.72	33.44	2.16
735	F7 L54	725	7-15 PRI	FDR	.02	7.72	33.43	2.16
735	F7 L54	745		FDR	.03	5.54	23.99	1.55
745		735	F7 L54	FDR	.03	5.54	23.98	1.55
745		750	F7 L72	FDR	.03	5.54	23.98	1.55
750	F7 L72	745		FDR	.03	5.54	23.98	1.55
800	FDR 8	90	SWGR O	FDR	.00	.00	.00	.00
900	FDR 9	90	SWGR O	FDR	.03	64.43	279.95	28.01
900	FDR 9	905	STEP SEC	TX2	.39	64.43	279.95	UNKNOW
905	STEP SEC	900	FDR 9	TX2	.39	21.48	278.90	UNKNOW
905	STEP SEC	910	F 96	FDR	.04	21.48	278.90	6.02
910	F 96	905	STEP SEC	FDR	.04	21.48	278.80	6.02
910	F 96	915	F910	FDR	.05	19.91	258.48	5.58

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
915	F910	910	F 96	FDR	.05	19.91	258.37	5.58
915	F910	920	F940	FDR	.27	19.91	258.37	5.58
920	F940	915	F910	FDR	.27	19.91	257.70	5.58
920	F940	945	F949 L1	FDR	.05	19.91	257.70	5.58
925	()	930	RICH SUB	FDR	.04	2.24	28.99	1.60
925	()	935	9-8 PRI	FDR	.04	2.24	28.99	2.14
930	RICH SUB	562	RS SEC	FDR	.00	2.24	29.00	1.60
930	RICH SUB	925	()	FDR	.04	2.24	29.00	1.60
935	9-8 PRI	925	()	FDR	.04	2.24	28.98	2.14
935	9-8 PRI	940	9-9 PRI	FDR	.11	1.35	17.38	1.28
940	9-9 PRI	935	9-8 PRI	FDR	.11	1.35	17.36	1.28
945	F949 L1	920	F940	FDR	.05	19.91	257.59	5.58
945	F949 L1	960	9-13 PRI	FDR	.31	19.53	252.65	10.61
960	9-13 PRI	945	F949 L1	FDR	.31	19.53	251.89	10.61
960	9-13 PRI	963	9-14 PRI	FDR	1.08	19.53	251.89	10.61
963	9-14 PRI	960	9-13 PRI	FDR	1.08	19.53	249.25	10.61
963	9-14 PRI	966	9-15 PRI	FDR	.29	17.99	229.61	9.78
966	9-15 PRI	963	9-14 PRI	FDR	.29	17.99	228.96	9.78
966	9-15 PRI	969	SW UP	FDR	.08	17.99	228.96	9.78
969	SW UP	966	9-15 PRI	FDR	.08	17.99	228.79	9.78
969	SW UP	972	SW DOWN	FDR	.00	17.99	228.79	3.87
972	SW DOWN	969	SW UP	FDR	.00	17.99	228.79	3.87
972	SW DOWN	975	9-16 PRI	FDR	1.10	17.99	228.79	9.78
975	9-16 PRI	972	SW DOWN	FDR	1.10	17.99	226.31	9.78
975	9-16 PRI	980		FDR	.46	17.99	226.31	9.78
980		975	9-16 PRI	FDR	.46	17.99	225.28	9.78
980		983	9-25 PRI	FDR	.79	17.99	225.28	9.78
983	9-25 PRI	980		FDR	.79	17.99	223.51	9.78
983	9-25 PRI	984	9-25 SEC	TX2	.00	.00	.00	UNKNOW
983	9-25 PRI	985	9-34 PRI	FDR	.07	4.83	60.03	2.63
984	9-25 SEC	983	9-25 PRI	TX2	.00	.00	.00	UNKNOW
985	9-34 PRI	983	9-25 PRI	FDR	.07	4.83	59.98	2.63
985	9-34 PRI	987		FDR	.23	4.83	59.98	2.63
987		985	9-34 PRI	FDR	.23	4.83	59.85	2.63
987		990	9-26 PRI	FDR	.20	2.83	35.07	1.54
987		992		FDR	.39	2.00	24.78	1.09
990	9-26 PRI	987		FDR	.20	2.83	34.99	1.54
992		987		FDR	.39	2.00	24.68	1.09
992		997	9-32 PRI	FDR	.07	2.00	24.68	1.09
997	9-32 PRI	992		FDR	.07	2.00	24.67	1.09

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

NOTE: FOR FEEDERS, RATING% = LOAD FLOW AMPS / FLA.
FLA = LIBRARY FLA EXCLUDING DUCT BANK AND TEMP. DERATING FOR CABLES.
FLA = BRANCH RECORD INPUT FLA FOR IMPEDANCE DATA.

NOTE: FOR TRANSFORMERS, RATING% = LOAD FLOW KVA / TRANSFORMER FULL LOAD KVA.

78 BUSES

*** T O T A L   S Y S T E M   L O S S E S ***
13.6 KW   13.9 KVAR

WARNING STUDY CONTAINS   2 VOLTAGE CRITERIA VIOLATIONS
VIOLATIONS DENOTED BY ($) AT BUS AND BRANCH %VD LOCATIONS

APPENDIX I

Load Flow Analysis - Case 4

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

DATE: 27 NOV 95
TIME: 9 12 AM

ALL INFORMATION PRESENTED IS FOR REVIEW, APPROVAL
INTERPRETATION AND APPLICATION BY A REGISTERED
ENGINEER ONLY

DAPPER (LOAD FLOW AND VOLTAGE DROP MINI/MICRO VERSION 4.5 LEVEL 1.0)

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

SWING GENERATORS

BUS NO	ID	STAT	VOLTAGE	ANGLE
80	6	1	1.000	.000

PV GENERATORS

BUS NO	ID	STAT	VOLTAGE	kW	kVARMIN	kVARMAX	PARTICIPATION
10	1	1	1.000	1000.	0.	0.	1.000
20	2	1	1.000	0.	0.	0.	1.000
30	3	1	1.000	0.	0.	0.	1.000
40	4	1	1.000	0.	0.	0.	1.000
50	5	1	1.000	0.	0.	0.	1.000

NOTICE: BRANCH 725 7-15 PRI TO 730 F7 L43 IS OUT OF SERVICE
NOTICE: BRANCH 735 F7 L54 TO 740 7-17 PRI IS OUT OF SERVICE
NOTICE: BRANCH 750 F7 L72 TO 755 F7-33 IS OUT OF SERVICE
NOTICE: BRANCH 745 TO 760 7-21 PRI IS OUT OF SERVICE
NOTICE: BRANCH 760 7-21 PRI TO 765 7-22 PRI IS OUT OF SERVICE
NOTICE: BRANCH 765 7-22 PRI TO 770 7-23 PRI IS OUT OF SERVICE
NOTICE: BRANCH 770 7-23 PRI TO 775 7-24 PRI IS OUT OF SERVICE
NOTICE: BRANCH 800 FDR 8 TO 805 F8 L11 IS OUT OF SERVICE
NOTICE: BRANCH 805 F8 L11 TO 810 F8 L23 IS OUT OF SERVICE
NOTICE: BRANCH 810 F8 L23 TO 815 F8 L25 IS OUT OF SERVICE
NOTICE: BRANCH 810 F8 L23 TO 817 F8 22 IS OUT OF SERVICE
NOTICE: BRANCH 820 F8 30 UF1 TO 825 8-22 PRI IS OUT OF SERVICE
NOTICE: BRANCH 920 F940 TO 925 () IS OUT OF SERVICE
NOTICE: BRANCH 945 F949 L1 TO 950 9-12 PRI IS OUT OF SERVICE
NOTICE: BRANCH 950 9-12 PRI TO 955 9-11 PRI IS OUT OF SERVICE
NOTICE: BRANCH 975 9-16 PRI TO 977 9-19 PRI IS OUT OF SERVICE
NOTICE: BRANCH 980 TO 982 9-20 PRI IS OUT OF SERVICE
NOTICE: BRANCH 992 TO 995 9-30 PRI IS OUT OF SERVICE
NOTICE: BRANCH 121 F1 L63 TO 125 F1 L67 IS OUT OF SERVICE
NOTICE: BRANCH 125 F1 L67 TO 130 F1 L613 IS OUT OF SERVICE
NOTICE: BRANCH 125 F1 L67 TO 135 F1 L68 IS OUT OF SERVICE
NOTICE: BRANCH 205 TO 210 2-3 PRI IS OUT OF SERVICE
NOTICE: BRANCH 400 FDR 4 TO 401 4-1 PRI IS OUT OF SERVICE
NOTICE: BRANCH 305 F8 F311 TO 310 F3 19 IS OUT OF SERVICE
NOTICE: BRANCH 405 F4 10 TO 410 F417 UF1 IS OUT OF SERVICE
NOTICE: BRANCH 505 F4 F5 F6UF TO 510 5-1 PRI IS OUT OF SERVICE
NOTICE: BRANCH 515 F5 L24 TO 520 5-6 PRI IS OUT OF SERVICE
NOTICE: BRANCH 525 F5 L31 TO 530 F5 L39 IS OUT OF SERVICE
NOTICE: BRANCH 535 F537 L5 TO 540 F5 L5 UF1 IS OUT OF SERVICE
NOTICE: BRANCH 540 F5 L5 UF1 TO 545 F5 L56 UF1 IS OUT OF SERVICE
NOTICE: BRANCH 540 F5 L5 UF1 TO 550 F5 L55 IS OUT OF SERVICE
NOTICE: BRANCH 565 5-17 PRI TO 570 5-18 PRI IS OUT OF SERVICE
NOTICE: BRANCH 580 F5 L85 TO 585 F5 L87 UF1 IS OUT OF SERVICE
NOTICE: BRANCH 580 F5 L85 TO 590 F5 L8911 IS OUT OF SERVICE
NOTICE: BRANCH 590 F5 L8911 TO 595 F5 L8 25 IS OUT OF SERVICE

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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NOTICE: BRANCH  303 F713         TO  305 F8 F311     IS OUT OF SERVICE
NOTICE: BRANCH  817 F8 22        TO  820 F8 30 UF1   IS OUT OF SERVICE
NOTICE: BRANCH  210 2-3 PRI      TO  215 2-4 PRI     IS OUT OF SERVICE
NOTICE: BRANCH  215 2-4 PRI      TO  220 2-5 PRI     IS OUT OF SERVICE
NOTICE: BRANCH  512 5-3 PRI      TO  514 5-5 PRI     IS OUT OF SERVICE
NOTICE: BRANCH  210 2-3 PRI      TO  225 2-3 SEC     IS OUT OF SERVICE
NOTICE: BRANCH  215 2-4 PRI      TO  230 2-4 SEC     IS OUT OF SERVICE
NOTICE: BRANCH  410 F417 UF1     TO  415 4-6 SEC     IS OUT OF SERVICE
NOTICE: BRANCH  545 F5 L56 UF1   TO  547 5-16 SEC    IS OUT OF SERVICE
NOTICE: BRANCH  590 F5 L8911     TO  591 5-23 SEC    IS OUT OF SERVICE
NOTICE: BRANCH  590 F5 L8911     TO  593 5-24 SEC    IS OUT OF SERVICE
NOTICE: BRANCH  300 FDR 3        TO  301 F8 F311     IS OUT OF SERVICE
NOTICE: BRANCH  301 F8 F311      TO  303 F713        IS OUT OF SERVICE
NOTICE: BRANCH  401 4-1 PRI      TO  403 F1 F45      IS OUT OF SERVICE
NOTICE: BRANCH  403 F1 F45       TO  405 F4 10       IS OUT OF SERVICE
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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

F E E D E R   D A T A

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE	DUCT	INSUL
10 GEN G1	15 G1 STEP-UP	1	2400.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
20 GEN G2	25 G2 STEP-UP	1	2400.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
30 GEN G3	35 G3 STEP-UP	1	2400.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
40 GEN G4	70 SWGR N	1	4160.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
50 GEN G5	70 SWGR N	1	4160.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
60 SWGR S	66 SM1A BLUE	1	4160.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
60 SWGR S	70 SWGR N	1	4160.	5. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
60 SWGR S	100 FDR 1	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET					STATUS: EXISTING		
60 SWGR S	200 FDR 2	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET					STATUS: EXISTING		
60 SWGR S	300 FDR 3	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET					STATUS: EXISTING		
60 SWGR S	400 FDR 4	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET					STATUS: EXISTING		
60 SWGR S	500 FDR 5	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET					STATUS: EXISTING		
62 SS-1 SEC	64 MCC 4&5	1	480.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
64 MCC 4&5	68 BLUE SSS	1	480.	50. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET					STATUS: EXISTING		
70 SWGR N	90 SWGR O	1	4160.	10. FT	500	A	M	XLP
IMPEDANCE:	.0453 + J .0444 OHMS/M FEET					STATUS: EXISTING		

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

F E E D E R   D A T A

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	TYPE	DESCRIPTION DUCT	INSUL
85 T1 SEC	90 SWGR O	1	4160.	10. FT	500	A	M	XLP
IMPEDANCE:	.0453 + J .0444 OHMS/M FEET				STATUS: EXISTING			
90 SWGR O	600 O/H BUS	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET				STATUS: EXISTING			
90 SWGR O	700 FDR 7	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET				STATUS: EXISTING			
90 SWGR O	800 FDR 8	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET				STATUS: EXISTING			
90 SWGR O	900 FDR 9	1	4160.	50. FT	4/0	A	N	XLP
IMPEDANCE:	.1050 + J .0410 OHMS/M FEET				STATUS: EXISTING			
100 FDR 1	105 F1F12 14	1	4160.	1500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
105 F1F12 14	110 F1 L14	1	4160.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
110 F1 L14	115 F1 L15	1	4160.	300. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
110 F1 L14	120 F1 L31	1	4160.	400. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
120 F1 L31	121 F1 L63	1	4160.	450. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
121 F1 L63	122 F1 L64	1	4160.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
200 FDR 2	205	1	4160.	600. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
205	235 F5 F29	1	4160.	400. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
235 F5 F29	236 F2 F211	1	4160.	250. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			
236 F2 F211	240 F1 F213	1	4160.	250. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET				STATUS: EXISTING			

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	TYPE	DESCRIPTION DUCT	INSUL
500 FDR 5	505 F4 F5 F6UF	1	4160.	625. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS:	EXISTING	
505 F4 F5 F6UF	512 5-3 PRI	1	4160.	1600. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS:	EXISTING	
512 5-3 PRI	515 F5 L24	1	4160.	1200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS:	EXISTING	
515 F5 L24	525 F5 L31	1	4160.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS:	EXISTING	
525 F5 L31	531 F3 L41	1	4160.	500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS:	EXISTING	
525 F5 L31	535 F537 L5	1	4160.	1400. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS:	EXISTING	
531 F3 L41	535 F537 L5	1	4160.	900. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS:	EXISTING	
535 F537 L5	555	1	4160.	800. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET					STATUS:	EXISTING	
555	560 RICH SUB	1	4160.	3200. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET					STATUS:	EXISTING	
555	565 5-17 PRI	1	4160.	800. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET					STATUS:	EXISTING	
562 RS SEC	930 RICH SUB	1	13200.	5. FT	4	A	B	OH-3
IMPEDANCE:	.4360 + J .1380 OHMS/M FEET					STATUS:	EXISTING	
565 5-17 PRI	575 F5 51	1	4160.	300. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET					STATUS:	EXISTING	
575 F5 51	580 F5 L85	1	4160.	600. FT	2/0	A	B	OH-2
IMPEDANCE:	.1410 + J .1250 OHMS/M FEET					STATUS:	EXISTING	
700 FDR 7	705 WELL9 POL	1	4160.	50. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS:	EXISTING	
705 WELL9 POL	709 F9 F73	1	4160.	200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS:	EXISTING	

F E E D E R D A T A

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	TYPE	DESCRIPTION DUCT	INSUL
709 F9 F73	710 F7 L11	1	4160.	1000. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
710 F7 L11	715 F7 L13	1	4160.	500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
710 F7 L11	720 F713	1	4160.	500. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
720 F713	725 7-15 PRI	1	4160.	1200. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
725 7-15 PRI	735 F7 L54	1	4160.	350. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
735 F7 L54	745	1	4160.	625. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
745	750 F7 L72	1	4160.	525. FT	4/0	A	B	OH-2
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
905 STEP SEC	910 F 96	1	13200.	600. FT	4/0	A	B	OH-3
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
910 F 96	915 F910	1	13200.	800. FT	4/0	A	B	OH-3
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
915 F910	920 F940	1	13200.	4500. FT	4/0	A	B	OH-3
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
920 F940	945 F949 L1	1	13200.	800. FT	4/0	A	B	OH-3
IMPEDANCE:	.0900 + J .1200 OHMS/M FEET					STATUS: EXISTING		
925 ()	930 RICH SUB	1	13200.	1500. FT	4	A	B	OH-3
IMPEDANCE:	.4360 + J .1380 OHMS/M FEET					STATUS: EXISTING		
925 ()	935 9-8 PRI	1	13200.	1000. FT	6	A	B	OH-3
IMPEDANCE:	.6900 + J .1440 OHMS/M FEET					STATUS: EXISTING		
935 9-8 PRI	940 9-9 PRI	1	13200.	5000. FT	6	A	B	OH-3
IMPEDANCE:	.6900 + J .1440 OHMS/M FEET					STATUS: EXISTING		
945 F949 L1	960 9-13 PRI	1	13200.	2200. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET					STATUS: EXISTING		

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

F E E D E R D A T A

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER DESCRIPTION SIZE	TYPE	DUCT	INSUL
960 9-13 PRI	963 9-14 PRI	1	13200.	7600. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET				STATUS: EXISTING			
963 9-14 PRI	966 9-15 PRI	1	13200.	2200. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET				STATUS: EXISTING			
966 9-15 PRI	969 SW UP	1	13200.	600. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET				STATUS: EXISTING			
969 SW UP	972 SW DOWN	1	13200.	5. FT	500	C	M	XLP
IMPEDANCE:	.0300 + J .0526 OHMS/M FEET				STATUS: EXISTING			
972 SW DOWN	975 9-16 PRI	1	13200.	8400. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET				STATUS: EXISTING			
975 9-16 PRI	980	1	13200.	3500. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET				STATUS: EXISTING			
980	983 9-25 PRI	1	13200.	6000. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET				STATUS: EXISTING			
983 9-25 PRI	985 9-34 PRI	1	13200.	2000. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET				STATUS: EXISTING			
985 9-34 PRI	987	1	13200.	6400. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET				STATUS: EXISTING			
987	990 9-26 PRI	1	13200.	9800. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET				STATUS: EXISTING			
987	992	1	13200.	27000. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET				STATUS: EXISTING			
992	997 9-32 PRI	1	13200.	5000. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J .1320 OHMS/M FEET				STATUS: EXISTING			

T R A N S F O R M E R   D A T A

PRIMARY RECORD NO NAME	VOLTS L-L	PRI FLA	* SECONDARY RECORD NO NAME	VOLTS L-L	SEC FLA	NOMINAL KVA
15 G1 STEP-UP	2400.	361.	60 SWGR S	4160.	208.	1500.0
IMPEDANCE: 1.0000 + J 5.6623 PERCENT						
25 G2 STEP-UP	2400.	361.	60 SWGR S	4160.	208.	1500.0
IMPEDANCE: 1.0000 + J 5.6623 PERCENT						
35 G3 STEP-UP	2400.	361.	60 SWGR S	4160.	208.	1500.0
IMPEDANCE: 1.0000 + J 5.6623 PERCENT						
60 SWGR S	4160.	42.	62 SS-1 SEC	480.	361.	300.0
IMPEDANCE: .7816 + J 4.5331 PERCENT						
66 SM1A BLUE	4160.	69.	68 BLUE SSS	480.	601.	500.0
IMPEDANCE: .8156 + J 4.7302 PERCENT						
80 UTILITY	24900.	58.	85 T1 SEC	4160.	347.	2500.0
IMPEDANCE: .5546 + J 5.9341 PERCENT			TRANSFORMER FIXED TAP:			-5.0 %
90 SWGR O	4160.	42.	64 MCC 4&5	480.	361.	300.0
IMPEDANCE: .5709 + J 3.3111 PERCENT						
560 RICH SUB	4160.	83.	562 RS SEC	13200.	26.	600.0
IMPEDANCE: .9345 + J 5.4200 PERCENT						
705 WELL9 POL	4160.	21.	707 7-1 SEC	480.	180.	150.0
IMPEDANCE: .9345 + J 5.4200 PERCENT						
900 FDR 9	4160.	208.	905 STEP SEC	13200.	66.	1500.0
IMPEDANCE: .7816 + J 4.5331 PERCENT						
983 9-25 PRI	13200.	22.	984 9-25 SEC	208.	1388.	500.0
IMPEDANCE: .9345 + J 5.4200 PERCENT						

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

B U S S P E C I A L S T U D Y D A T A

NO	NAME	KW	KVAR	LOAD TYPE
120	F1 L31	43.	14.	CONSTANT Z LOAD
121	F1 L63	43.	14.	CONSTANT Z LOAD
122	F1 L64	74.	24.	CONSTANT Z LOAD
235	F5 F29	44.	14.	CONSTANT Z LOAD
236	F2 F211	88.	29.	CONSTANT Z LOAD
240	F1 F213	88.	29.	CONSTANT Z LOAD
525	F5 L31	8.	3.	CONSTANT Z LOAD
565	5-17 PRI	5.	2.	CONSTANT Z LOAD
580	F5 L85	8.	3.	CONSTANT Z LOAD
705	WELL9 POL	41.	14.	CONSTANT Z LOAD
709	F9 F73	83.	27.	CONSTANT Z LOAD
710	F7 L11	21.	7.	CONSTANT Z LOAD
715	F7 L13	21.	7.	CONSTANT Z LOAD
735	F7 L54	8.	3.	CONSTANT Z LOAD
750	F7 L72	21.	7.	CONSTANT Z LOAD
910	F 96	18.	6.	CONSTANT Z LOAD
935	9-8 PRI	10.	3.	CONSTANT Z LOAD
940	9-9 PRI	15.	5.	CONSTANT Z LOAD
945	F949 L1	4.	1.	CONSTANT Z LOAD
960	9-13 PRI	18.	6.	CONSTANT Z LOAD
963	9-14 PRI	18.	6.	CONSTANT Z LOAD
983	9-25 PRI	157.	51.	CONSTANT Z LOAD
990	9-26 PRI	34.	11.	CONSTANT Z LOAD
997	9-32 PRI	24.	8.	CONSTANT Z LOAD

*** SOLUTION COMMENTS ***
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SOLUTION PARAMETERS

BRANCH VOLTAGE CRITERIA	:	4.00 %
BUS VOLTAGE CRITERIA	:	5.00 %
ACCELERATION FACTOR FOR 'PV' GENERATORS	:	1.00
ACCELERATION FACTOR FOR CONSTANT KVA LOADS	:	1.00
EXACT(ITERATIVE) SOLUTION	:	YES

<<PERCENT VOLTAGE DROPS ARE BASED ON NOMINAL DESIGN VOLTAGES>>

TOF SIZE: 301

LARGEST LOAD:	1000.00 KVA		
CONVERGENCE CRITERIA:	.050 KVA		
LARGEST BUS MISMATCH	10	GEN G1	104.765 KVA
LARGEST BUS MISMATCH	10	GEN G1	5.926 KVA
LARGEST BUS MISMATCH	10	GEN G1	.336 KVA
LARGEST BUS MISMATCH	10	GEN G1	.019 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (SWING GENERATORS)
****

BUS	VOLTS(PU)	ANGLE	KW	KVAR	VD%	R + JX (PU)
80	1.000	.00	-26.7	361.2	.0	

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (PV GENERATOR SCHEDULE REPORT)
****

BUS NAME	ID	---VOLTAGE--- SCHED.	ACTUAL	-KVAR LIMITS- MIN	MAX	---ACTUAL---- KW	KVAR
10 GEN G1	1	1.000	1.050	.0	.0	1000.0	.0
20 GEN G2	2	1.000	1.045	.0	.0	.0	.0
30 GEN G3	3	1.000	1.045	.0	.0	.0	.0
40 GEN G4	4	1.000	1.045	.0	.0	.0	.0
50 GEN G5	5	1.000	1.045	.0	.0	.0	.0

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:    10 GEN G1     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2521 %VD: -5.0
======================== PU BUS VOLTAGE:  1.050        ANGLE:   2.1 DEGREES
             ** PV TYPE GENERATOR:    1     1000.0 KW        .0 KVAR

LOAD   TO:   15 G1 STEP-UP   FEEDER AMPS:   229 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:    1000.0 KW       .0 KVAR    1000.0 KVA  PF:1.00 UNITY
LOSSES THRU FEEDER:          .2 KW       .4 KVAR        .5 KVA


==== BUS:    15 G1 STEP-UP DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2521 %VD: -5.0
======================== PU BUS VOLTAGE:  1.050        ANGLE:   2.0 DEGREES

LOAD FROM:   10 GEN G1       FEEDER AMPS:   229 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     999.8 KW      -.4 KVAR     999.8 KVA  PF:1.00 UNITY
LOSSES THRU FEEDER:          .2 KW       .4 KVAR        .5 KVA

LOAD   TO:   60 SWGR S       TRANSF AMPS:   229 VOLTAGE DROP:   14. %VD:   .6
PROJECTED POWER FLOW:     999.8 KW      -.4 KVAR     999.8 KVA  PF:1.00 UNITY
LOSSES THRU TRANSF:       6.0 KW    34.2 KVAR    34.7 KVA


==== BUS:    20 GEN G2     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2507 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045        ANGLE:    .1 DEGREES
             ** PV TYPE GENERATOR:    2        .0 KW        .0 KVAR
**** NO LOAD SPECIFIED ****


==== BUS:    25 G2 STEP-UP DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2507 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045        ANGLE:    .1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:    30 GEN G3     DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2507 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045        ANGLE:    .1 DEGREES
             ** PV TYPE GENERATOR:    3        .0 KW        .0 KVAR
**** NO LOAD SPECIFIED ****
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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:   35 G3 STEP-UP DESIGN VOLTAGE:  2400  BUS VOLTAGE:  2507 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045       ANGLE:     .1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:   40 GEN G4     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045       ANGLE:     .1 DEGREES
              ** PV TYPE GENERATOR:    4          .0 KW        .0 KVAR
**** NO LOAD SPECIFIED ****


==== BUS:   50 GEN G5     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045       ANGLE:     .1 DEGREES
              ** PV TYPE GENERATOR:    5          .0 KW        .0 KVAR
**** NO LOAD SPECIFIED ****


==== BUS:   60 SWGR S     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045       ANGLE:     .1 DEGREES

LOAD FROM:   15 G1 STEP-UP   TRANSF AMPS:   132 VOLTAGE DROP:   24. %VD:    .6
PROJECTED POWER FLOW:     993.7 KW    -34.6 KVAR     994.3 KVA  PF:1.00 UNITY
LOSSES THRU TRANSF:      6.0 KW    34.2 KVAR     34.7 KVA

LOAD FROM:   25 G2 STEP-UP   TRANSF AMPS:       VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:         .0 KW        .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:       .0 KW       .0 KVAR       .0 KVA

LOAD FROM:   35 G3 STEP-UP   TRANSF AMPS:       VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:         .0 KW        .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:       .0 KW       .0 KVAR       .0 KVA

LOAD    TO:   62 SS-1 SEC     TRANSF AMPS:       VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:         .1 KW        .0 KVAR        .1 KVA  PF: .98 LAGGING
LOSSES THRU TRANSF:       .0 KW       .0 KVAR       .0 KVA

LOAD    TO:   66 SM1A BLUE    FEEDER AMPS:       VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:         .1 KW        .0 KVAR        .1 KVA  PF: .98 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD    TO:   70 SWGR N       FEEDER AMPS:    75 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     530.6 KW   -189.1 KVAR     563.3 KVA  PF: .94 LEADING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA
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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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             BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD    TO:  100 FDR 1        FEEDER AMPS:    24 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:    172.8 KW     57.2 KVAR     182.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD    TO:  200 FDR 2        FEEDER AMPS:    33 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:    239.4 KW     78.7 KVAR     252.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD    TO:  300 FDR 3        FEEDER AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .0 KW       .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD    TO:  400 FDR 4        FEEDER AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .0 KW       .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD    TO:  500 FDR 5        FEEDER AMPS:     7 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     50.8 KW     18.6 KVAR      54.1 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

==== BUS:    62 SS-1 SEC    DESIGN VOLTAGE:   480  BUS VOLTAGE:   501 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045        ANGLE:     .1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:    64 MCC 4&5     DESIGN VOLTAGE:   480  BUS VOLTAGE:   501 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045        ANGLE:     .1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:    66 SM1A BLUE   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045        ANGLE:     .1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:    68 BLUE SSS    DESIGN VOLTAGE:   480  BUS VOLTAGE:   501 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045        ANGLE:     .1 DEGREES
**** NO LOAD SPECIFIED ****
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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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              BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:   70 SWGR N     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045        ANGLE:    .1 DEGREES

LOAD FROM:   40 GEN G4       FEEDER AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .0 KW       .0 KVAR       .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD FROM:   50 GEN G5       FEEDER AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:       .0 KW       .0 KVAR       .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD FROM:   60 SWGR S       FEEDER AMPS:    75 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:    530.6 KW   -189.1 KVAR    563.3 KVA  PF: .94 LEADING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD   TO:   90 SWGR O       FEEDER AMPS:    75 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:    530.6 KW   -189.1 KVAR    563.3 KVA  PF: .94 LEADING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:   80 UTILITY    DESIGN VOLTAGE: 24900  BUS VOLTAGE: 24900 %VD:    .0
======================== PU BUS VOLTAGE:  1.000        ANGLE:    .0 DEGREES
             *** SWING  GENERATOR:   6        -26.7 KW       361.2 KVAR

LOAD FROM:   85 T1 SEC       TRANSF AMPS:     8 VOLTAGE DROP: 1109. %VD:  4.5$
PROJECTED POWER FLOW:     26.7 KW   -361.2 KVAR    362.2 KVA  PF: .07 LEADING
LOSSES THRU TRANSF:      .3 KW     2.8 KVAR     2.8 KVA **XFMR TAPS  -5.0%**


==== BUS:   85 T1 SEC     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045        ANGLE:    .1 DEGREES

LOAD   TO:   80 UTILITY      TRANSF AMPS:    48 VOLTAGE DROP:  185. %VD:  4.5$
PROJECTED POWER FLOW:     27.0 KW   -358.4 KVAR    359.4 KVA  PF: .08 LEADING
LOSSES THRU TRANSF:      .3 KW     2.8 KVAR     2.8 KVA **XFMR TAPS  -5.0%**

LOAD FROM:   90 SWGR O       FEEDER AMPS:    48 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     27.0 KW   -358.4 KVAR    359.4 KVA  PF: .08 LEADING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA
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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

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*******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:   90 SWGR O     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.5
======================= PU BUS VOLTAGE:  1.045        ANGLE:    .1 DEGREES

LOAD FROM:    64 MCC 4&5      TRANSF AMPS:        VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:         .2 KW        .0 KVAR         .2 KVA  PF: .98 LAGGING
LOSSES THRU TRANSF:       .0 KW      .0 KVAR       .0 KVA

LOAD FROM:    70 SWGR N       FEEDER AMPS:    75 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     530.6 KW   -189.1 KVAR     563.3 KVA  PF: .94 LEADING
LOSSES THRU FEEDER:           .0 KW        .0 KVAR         .0 KVA

LOAD    TO:   85 T1 SEC       FEEDER AMPS:    48 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      27.0 KW   -358.4 KVAR     359.4 KVA  PF: .08 LEADING
LOSSES THRU FEEDER:           .0 KW        .0 KVAR         .0 KVA

LOAD    TO:  600 O/H BUS      FEEDER AMPS:        VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:         .0 KW        .0 KVAR         .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:           .0 KW        .0 KVAR         .0 KVA

LOAD    TO:  700 FDR 7        FEEDER AMPS:    30 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     212.5 KW     70.4 KVAR     223.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .0 KW        .0 KVAR         .0 KVA

LOAD    TO:  800 FDR 8        FEEDER AMPS:        VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:         .0 KW        .0 KVAR         .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:           .0 KW        .0 KVAR         .0 KVA

LOAD    TO:  900 FDR 9        FEEDER AMPS:    41 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     291.3 KW     98.9 KVAR     307.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .0 KW        .0 KVAR         .0 KVA


==== BUS:  100 FDR 1      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.4
======================= PU BUS VOLTAGE:  1.044        ANGLE:    .1 DEGREES

LOAD FROM:    60 SWGR S       FEEDER AMPS:    24 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     172.7 KW     57.2 KVAR     182.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .0 KW        .0 KVAR         .0 KVA

LOAD    TO:  105 F1F12 14     FEEDER AMPS:    24 VOLTAGE DROP:    8. %VD:    .2
PROJECTED POWER FLOW:     172.7 KW     57.2 KVAR     182.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:           .2 KW        .3 KVAR         .4 KVA
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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                 BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  105 F1F12 14   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4337 %VD: -4.3
======================== PU BUS VOLTAGE:  1.043        ANGLE:    .0 DEGREES

LOAD FROM:  100 FDR 1         FEEDER AMPS:    24 VOLTAGE DROP:    8. %VD:   .2
PROJECTED POWER FLOW:     172.5 KW      56.8 KVAR    181.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .3 KVAR       .4 KVA

LOAD    TO:  110 F1 L14       FEEDER AMPS:    24 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     172.5 KW      56.8 KVAR    181.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .1 KVA


==== BUS:  110 F1 L14     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4336 %VD: -4.2
======================== PU BUS VOLTAGE:  1.042        ANGLE:    .0 DEGREES

LOAD FROM:  105 F1F12 14      FEEDER AMPS:    24 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     172.5 KW      56.8 KVAR    181.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .1 KVA

LOAD    TO:  115 F1 L15       FEEDER AMPS:       VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .0 KW        .0 KVAR       .0 KVA  PF: .00 LEADING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR       .0 KVA

LOAD    TO:  120 F1 L31       FEEDER AMPS:    24 VOLTAGE DROP:    2. %VD:   .0
PROJECTED POWER FLOW:     172.5 KW      56.8 KVAR    181.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR       .1 KVA


==== BUS:  115 F1 L15     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4336 %VD: -4.2
======================== PU BUS VOLTAGE:  1.042        ANGLE:    .0 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  120 F1 L31     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4334 %VD: -4.2
======================== PU BUS VOLTAGE:  1.042        ANGLE:    .0 DEGREES
              PROJECTED SPECIAL BUS LOAD:      46.2 KW      15.2 KVAR

LOAD FROM:  110 F1 L14        FEEDER AMPS:    24 VOLTAGE DROP:    2. %VD:   .0
PROJECTED POWER FLOW:     172.4 KW      56.7 KVAR    181.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .1 KVAR       .1 KVA
```

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD    TO:  121 F1 L63       FEEDER AMPS:     18 VOLTAGE DROP:    2. %VD:    .0
PROJECTED POWER FLOW:     126.2 KW     41.5 KVAR     132.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .1 KVAR        .1 KVA


==== BUS:  121 F1 L63     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4332 %VD: -4.1
======================== PU BUS VOLTAGE:  1.041       ANGLE:    .0 DEGREES
              PROJECTED SPECIAL BUS LOAD:     46.2 KW      15.2 KVAR

LOAD FROM:  120 F1 L31       FEEDER AMPS:     18 VOLTAGE DROP:    2. %VD:    .0
PROJECTED POWER FLOW:     126.2 KW     41.5 KVAR     132.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .1 KVAR        .1 KVA

LOAD    TO:  122 F1 L64       FEEDER AMPS:     11 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      80.0 KW     26.3 KVAR      84.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA


==== BUS:  122 F1 L64     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4332 %VD: -4.1
======================== PU BUS VOLTAGE:  1.041       ANGLE:    .0 DEGREES
              PROJECTED SPECIAL BUS LOAD:     80.0 KW      26.3 KVAR

LOAD FROM:  121 F1 L63       FEEDER AMPS:     11 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      80.0 KW     26.3 KVAR      84.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA


==== BUS:  200 FDR 2      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.4
======================== PU BUS VOLTAGE:  1.044       ANGLE:    .1 DEGREES

LOAD FROM:   60 SWGR S       FEEDER AMPS:     33 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     239.4 KW     78.7 KVAR     252.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD    TO:  205             FEEDER AMPS:     33 VOLTAGE DROP:    4. %VD:    .1
PROJECTED POWER FLOW:     239.4 KW     78.7 KVAR     252.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW       .2 KVAR        .3 KVA
```

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

```
                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %    BUS =  5.00


==== BUS:  205           DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4341 %VD: -4.3
========================= PU BUS VOLTAGE:  1.043       ANGLE:    .0 DEGREES

LOAD FROM:  200 FDR 2       FEEDER AMPS:    33 VOLTAGE DROP:    4. %VD:    .1
PROJECTED POWER FLOW:     239.2 KW     78.5 KVAR    251.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW       .2 KVAR       .3 KVA

LOAD   TO:  235 F5 F29      FEEDER AMPS:    33 VOLTAGE DROP:    3. %VD:    .1
PROJECTED POWER FLOW:     239.2 KW     78.5 KVAR    251.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .2 KVAR       .2 KVA


==== BUS:  235 F5 F29    DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4338 %VD: -4.3
========================= PU BUS VOLTAGE:  1.043       ANGLE:    .0 DEGREES
              PROJECTED SPECIAL BUS LOAD:     47.8 KW      15.2 KVAR

LOAD FROM:  205             FEEDER AMPS:    33 VOLTAGE DROP:    3. %VD:    .1
PROJECTED POWER FLOW:     239.1 KW     78.3 KVAR    251.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .2 KVAR       .2 KVA

LOAD   TO:  236 F2 F211     FEEDER AMPS:    27 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     191.3 KW     63.1 KVAR    201.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .1 KVAR       .1 KVA


==== BUS:  236 F2 F211   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4336 %VD: -4.2
========================= PU BUS VOLTAGE:  1.042       ANGLE:    .0 DEGREES
              PROJECTED SPECIAL BUS LOAD:     95.6 KW      31.5 KVAR

LOAD FROM:  235 F5 F29      FEEDER AMPS:    27 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     191.2 KW     63.0 KVAR    201.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .1 KVAR       .1 KVA

LOAD   TO:  240 F1 F213     FEEDER AMPS:    13 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:      95.6 KW     31.5 KVAR    100.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA
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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  240 F1 F213    DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4336 %VD: -4.2
========================= PU BUS VOLTAGE:  1.042       ANGLE:    .0 DEGREES
              PROJECTED SPECIAL BUS LOAD:     95.6 KW     31.5 KVAR

LOAD FROM:  236 F2 F211      FEEDER AMPS:    13 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      95.6 KW     31.5 KVAR    100.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA


==== BUS:  300 FDR 3      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.5
========================= PU BUS VOLTAGE:  1.045       ANGLE:    .1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  400 FDR 4      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.5
========================= PU BUS VOLTAGE:  1.045       ANGLE:    .1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  500 FDR 5      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.5
========================= PU BUS VOLTAGE:  1.045       ANGLE:    .1 DEGREES

LOAD FROM:   60 SWGR S       FEEDER AMPS:     7 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      50.8 KW     18.6 KVAR     54.1 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  505 F4 F5 F6UF  FEEDER AMPS:     7 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      50.8 KW     18.6 KVAR     54.1 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA


==== BUS:  505 F4 F5 F6UF DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4344 %VD: -4.4
========================= PU BUS VOLTAGE:  1.044       ANGLE:    .1 DEGREES

LOAD FROM:  500 FDR 5        FEEDER AMPS:     7 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      50.7 KW     18.6 KVAR     54.0 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  512 5-3 PRI      FEEDER AMPS:     7 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:      50.7 KW     18.6 KVAR     54.0 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR       .0 KVA
```

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                   BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
********************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  512 5-3 PRI    DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4342 %VD: -4.4
======================== PU BUS VOLTAGE:  1.044        ANGLE:    .0 DEGREES

LOAD FROM:  505 F4 F5 F6UF   FEEDER AMPS:     7 VOLTAGE DROP:    3. %VD:   .1
PROJECTED POWER FLOW:      50.7 KW     18.6 KVAR      54.0 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  515 F5 L24       FEEDER AMPS:     7 VOLTAGE DROP:    2. %VD:   .0
PROJECTED POWER FLOW:      50.7 KW     18.6 KVAR      54.0 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA


==== BUS:  515 F5 L24     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4340 %VD: -4.3
======================== PU BUS VOLTAGE:  1.043        ANGLE:    .0 DEGREES

LOAD FROM:  512 5-3 PRI      FEEDER AMPS:     7 VOLTAGE DROP:    2. %VD:   .0
PROJECTED POWER FLOW:      50.7 KW     18.5 KVAR      54.0 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  525 F5 L31       FEEDER AMPS:     7 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      50.7 KW     18.5 KVAR      54.0 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA


==== BUS:  525 F5 L31     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4339 %VD: -4.3
======================== PU BUS VOLTAGE:  1.043        ANGLE:    .0 DEGREES
              PROJECTED SPECIAL BUS LOAD:       8.7 KW       3.6 KVAR

LOAD FROM:  515 F5 L24       FEEDER AMPS:     7 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      50.7 KW     18.5 KVAR      54.0 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  531 F3 L41       FEEDER AMPS:     3 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      21.0 KW      7.5 KVAR      22.3 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  535 F537 L5      FEEDER AMPS:     3 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:      21.0 KW      7.5 KVAR      22.3 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA
```

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  531 F3 L41      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4339 %VD: -4.3
======================== PU BUS VOLTAGE:  1.043        ANGLE:     .0 DEGREES

LOAD FROM:  525 F5 L31      FEEDER AMPS:     3 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     21.0 KW      7.5 KVAR      22.3 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  535 F537 L5     FEEDER AMPS:     3 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     21.0 KW      7.5 KVAR      22.3 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA


==== BUS:  535 F537 L5     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4339 %VD: -4.3
======================== PU BUS VOLTAGE:  1.043        ANGLE:     .0 DEGREES

LOAD FROM:  525 F5 L31      FEEDER AMPS:     3 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     21.0 KW      7.5 KVAR      22.3 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD FROM:  531 F3 L41      FEEDER AMPS:     3 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     21.0 KW      7.5 KVAR      22.3 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  555             FEEDER AMPS:     6 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     42.0 KW     14.9 KVAR      44.6 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA


==== BUS:  555             DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4337 %VD: -4.3
======================== PU BUS VOLTAGE:  1.043        ANGLE:     .0 DEGREES

LOAD FROM:  535 F537 L5     FEEDER AMPS:     6 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     42.0 KW     14.9 KVAR      44.6 KVA  PF: .94 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  560 RICH SUB    FEEDER AMPS:     4 VOLTAGE DROP:    4. %VD:    .1
PROJECTED POWER FLOW:     27.9 KW      9.2 KVAR      29.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  565 5-17 PRI    FEEDER AMPS:     2 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     14.1 KW      5.7 KVAR      15.2 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  560 RICH SUB   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4333 %VD: -4.2
========================= PU BUS VOLTAGE:  1.042       ANGLE:    .0 DEGREES

LOAD FROM:  555             FEEDER AMPS:     4 VOLTAGE DROP:    4. %VD:   .1
PROJECTED POWER FLOW:     27.8 KW      9.2 KVAR      29.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  562 RS SEC      TRANSF AMPS:     4 VOLTAGE DROP:    5. %VD:   .1
PROJECTED POWER FLOW:     27.8 KW      9.2 KVAR      29.3 KVA  PF: .95 LAGGING
LOSSES THRU TRANSF:      .0 KW      .1 KVAR      .1 KVA


==== BUS:  562 RS SEC     DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13734 %VD: -4.0
========================= PU BUS VOLTAGE:  1.040       ANGLE:   -.1 DEGREES

LOAD FROM:  560 RICH SUB    TRANSF AMPS:     1 VOLTAGE DROP:   16. %VD:   .1
PROJECTED POWER FLOW:     27.8 KW      9.1 KVAR      29.3 KVA  PF: .95 LAGGING
LOSSES THRU TRANSF:      .0 KW      .1 KVAR      .1 KVA

LOAD   TO:  930 RICH SUB    FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     27.8 KW      9.1 KVAR      29.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA


==== BUS:  565 5-17 PRI   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4337 %VD: -4.2
========================= PU BUS VOLTAGE:  1.042       ANGLE:    .0 DEGREES
              PROJECTED SPECIAL BUS LOAD:       5.4 KW       2.1 KVAR

LOAD FROM:  555             FEEDER AMPS:     2 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     14.1 KW      5.7 KVAR      15.2 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  575 F5 51       FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      8.7 KW      3.6 KVAR       9.4 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR        .0 KVA
```

```
CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  575 F5 51      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4337 %VD: -4.2
======================== PU BUS VOLTAGE:  1.042       ANGLE:    .0 DEGREES

LOAD FROM:  565 5-17 PRI     FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      8.7 KW       3.6 KVAR       9.4 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  580 F5 L85       FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      8.7 KW       3.6 KVAR       9.4 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  580 F5 L85     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4336 %VD: -4.2
======================== PU BUS VOLTAGE:  1.042       ANGLE:    .0 DEGREES
              PROJECTED SPECIAL BUS LOAD:      8.7 KW      3.6 KVAR

LOAD FROM:  575 F5 51        FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:      8.7 KW       3.6 KVAR       9.4 KVA  PF: .93 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  600 O/H BUS    DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045       ANGLE:    .1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  700 FDR 7      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.4
======================== PU BUS VOLTAGE:  1.044       ANGLE:    .1 DEGREES

LOAD FROM:   90 SWGR O       FEEDER AMPS:    30 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:    212.5 KW      70.4 KVAR     223.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  705 WELL9 POL    FEEDER AMPS:    30 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:    212.5 KW      70.4 KVAR     223.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA
```

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

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*******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  705 WELL9 POL  DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.4
======================== PU BUS VOLTAGE:  1.044        ANGLE:    .1 DEGREES
              PROJECTED SPECIAL BUS LOAD:     44.7 KW      15.3 KVAR

LOAD FROM:  700 FDR 7         FEEDER AMPS:    30 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     212.5 KW      70.4 KVAR     223.8 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD FROM:  707 7-1 SEC       TRANSF AMPS:       VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:        .0 KW        .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:       .0 KW      .0 KVAR      .0 KVA

LOAD   TO:  709 F9 F73        FEEDER AMPS:    23 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     167.8 KW      55.1 KVAR     176.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA


==== BUS:  707 7-1 SEC    DESIGN VOLTAGE:   480  BUS VOLTAGE:   501 %VD: -4.4
======================== PU BUS VOLTAGE:  1.044        ANGLE:    .1 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  709 F9 F73     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4344 %VD: -4.4
======================== PU BUS VOLTAGE:  1.044        ANGLE:    .1 DEGREES
              PROJECTED SPECIAL BUS LOAD:     90.5 KW      29.4 KVAR

LOAD FROM:  705 WELL9 POL     FEEDER AMPS:    23 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     167.7 KW      55.1 KVAR     176.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  710 F7 L11        FEEDER AMPS:    11 VOLTAGE DROP:    2. %VD:    .1
PROJECTED POWER FLOW:      77.3 KW      25.7 KVAR      81.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .1 KVA


==== BUS:  710 F7 L11     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4341 %VD: -4.4
======================== PU BUS VOLTAGE:  1.044        ANGLE:    .0 DEGREES
              PROJECTED SPECIAL BUS LOAD:     22.5 KW       7.4 KVAR

LOAD FROM:  709 F9 F73        FEEDER AMPS:    11 VOLTAGE DROP:    2. %VD:    .1
PROJECTED POWER FLOW:      77.2 KW      25.6 KVAR      81.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .1 KVA
```

```
               BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD   TO:  715 F7 L13       FEEDER AMPS:     3 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     22.9 KW       7.6 KVAR      24.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  720 F713         FEEDER AMPS:     4 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     31.9 KW      10.6 KVAR      33.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  715 F7 L13     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4341 %VD: -4.3
======================== PU BUS VOLTAGE:  1.043        ANGLE:    .0 DEGREES
              PROJECTED SPECIAL BUS LOAD:     22.9 KW       7.6 KVAR

LOAD FROM:  710 F7 L11       FEEDER AMPS:     3 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     22.9 KW       7.6 KVAR      24.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  720 F713       DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4341 %VD: -4.3
======================== PU BUS VOLTAGE:  1.043        ANGLE:    .0 DEGREES

LOAD FROM:  710 F7 L11       FEEDER AMPS:     4 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     31.9 KW      10.6 KVAR      33.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  725 7-15 PRI     FEEDER AMPS:     4 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     31.9 KW      10.6 KVAR      33.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  725 7-15 PRI   DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4340 %VD: -4.3
======================== PU BUS VOLTAGE:  1.043        ANGLE:    .0 DEGREES

LOAD FROM:  720 F713         FEEDER AMPS:     4 VOLTAGE DROP:    1. %VD:   .0
PROJECTED POWER FLOW:     31.8 KW      10.6 KVAR      33.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  735 F7 L54       FEEDER AMPS:     4 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     31.8 KW      10.6 KVAR      33.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA
```

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

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********************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  735 F7 L54     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4339 %VD: -4.3
======================== PU BUS VOLTAGE:  1.043        ANGLE:     .0 DEGREES
              PROJECTED SPECIAL BUS LOAD:       9.0 KW       3.0 KVAR

LOAD FROM:  725 7-15 PRI     FEEDER AMPS:      4 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      31.8 KW      10.6 KVAR      33.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  745              FEEDER AMPS:      3 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      22.8 KW       7.6 KVAR      24.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA


==== BUS:  745            DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4339 %VD: -4.3
======================== PU BUS VOLTAGE:  1.043        ANGLE:     .0 DEGREES

LOAD FROM:  735 F7 L54       FEEDER AMPS:      3 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      22.8 KW       7.6 KVAR      24.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  750 F7 L72       FEEDER AMPS:      3 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      22.8 KW       7.6 KVAR      24.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA


==== BUS:  750 F7 L72     DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4339 %VD: -4.3
======================== PU BUS VOLTAGE:  1.043        ANGLE:     .0 DEGREES
              PROJECTED SPECIAL BUS LOAD:      22.8 KW       7.6 KVAR

LOAD FROM:  745              FEEDER AMPS:      3 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:      22.8 KW       7.6 KVAR      24.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA


==== BUS:  800 FDR 8      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.5
======================== PU BUS VOLTAGE:  1.045        ANGLE:     .1 DEGREES
**** NO LOAD SPECIFIED ****
```

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
***********************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  900 FDR 9      DESIGN VOLTAGE:  4160  BUS VOLTAGE:  4345 %VD: -4.4
======================== PU BUS VOLTAGE:  1.044       ANGLE:    .1 DEGREES

LOAD FROM:    90 SWGR 0       FEEDER AMPS:    41 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:    291.3 KW      98.9 KVAR     307.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  905 STEP SEC     TRANSF AMPS:    41 VOLTAGE DROP:   18. %VD:    .4
PROJECTED POWER FLOW:    291.3 KW      98.9 KVAR     307.6 KVA  PF: .95 LAGGING
LOSSES THRU TRANSF:       .5 KW     2.6 KVAR      2.7 KVA


==== BUS:  905 STEP SEC   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13730 %VD: -4.0
======================== PU BUS VOLTAGE:  1.040       ANGLE:   -.4 DEGREES

LOAD FROM:  900 FDR 9        TRANSF AMPS:    13 VOLTAGE DROP:   57. %VD:    .4
PROJECTED POWER FLOW:    290.8 KW      96.3 KVAR     306.3 KVA  PF: .95 LAGGING
LOSSES THRU TRANSF:       .5 KW     2.6 KVAR      2.7 KVA

LOAD   TO:  910 F 96         FEEDER AMPS:    13 VOLTAGE DROP:    2. %VD:    .0
PROJECTED POWER FLOW:    290.8 KW      96.3 KVAR     306.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  910 F 96       DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13728 %VD: -4.0
======================== PU BUS VOLTAGE:  1.040       ANGLE:   -.4 DEGREES
               PROJECTED SPECIAL BUS LOAD:     19.3 KW       6.3 KVAR

LOAD FROM:  905 STEP SEC     FEEDER AMPS:    13 VOLTAGE DROP:    2. %VD:    .0
PROJECTED POWER FLOW:    290.8 KW      96.2 KVAR     306.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  915 F910         FEEDER AMPS:    12 VOLTAGE DROP:    2. %VD:    .0
PROJECTED POWER FLOW:    271.5 KW      89.9 KVAR     286.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .1 KVA
```

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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              BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  915 F910       DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13726 %VD: -4.0
======================== PU BUS VOLTAGE:  1.040       ANGLE:   -.4 DEGREES

LOAD FROM:  910 F 96        FEEDER AMPS:    12 VOLTAGE DROP:    2. %VD:    .0
PROJECTED POWER FLOW:    271.5 KW      89.8 KVAR     286.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .1 KVA

LOAD   TO:  920 F940        FEEDER AMPS:    12 VOLTAGE DROP:   12. %VD:    .1
PROJECTED POWER FLOW:    271.5 KW      89.8 KVAR     286.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .2 KW        .2 KVAR        .3 KVA


==== BUS:  920 F940       DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13715 %VD: -3.9
======================== PU BUS VOLTAGE:  1.039       ANGLE:   -.4 DEGREES

LOAD FROM:  915 F910        FEEDER AMPS:    12 VOLTAGE DROP:   12. %VD:    .1
PROJECTED POWER FLOW:    271.3 KW      89.6 KVAR     285.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .2 KW        .2 KVAR        .3 KVA

LOAD   TO:  945 F949 L1     FEEDER AMPS:    12 VOLTAGE DROP:    2. %VD:    .0
PROJECTED POWER FLOW:    271.3 KW      89.6 KVAR     285.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .1 KVA


==== BUS:  925 ()         DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13733 %VD: -4.0
======================== PU BUS VOLTAGE:  1.040       ANGLE:   -.1 DEGREES

LOAD FROM:  930 RICH SUB    FEEDER AMPS:     1 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     27.8 KW       9.1 KVAR      29.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  935 9-8 PRI     FEEDER AMPS:     1 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:     27.8 KW       9.1 KVAR      29.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA


==== BUS:  930 RICH SUB   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13734 %VD: -4.0
======================== PU BUS VOLTAGE:  1.040       ANGLE:   -.1 DEGREES

LOAD FROM:  562 RS SEC      FEEDER AMPS:     1 VOLTAGE DROP:    0. %VD:    .0
PROJECTED POWER FLOW:     27.8 KW       9.1 KVAR      29.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW        .0 KVAR        .0 KVA
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              BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD   TO:  925 ()            FEEDER AMPS:     1 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:      27.8 KW       9.1 KVAR      29.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA


==== BUS:  935 9-8 PRI    DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13731 %VD: -4.0
======================== PU BUS VOLTAGE:  1.040       ANGLE:   -.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:      11.1 KW       3.7 KVAR

LOAD FROM:  925 ()            FEEDER AMPS:     1 VOLTAGE DROP:    1. %VD:    .0
PROJECTED POWER FLOW:      27.8 KW       9.1 KVAR      29.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD   TO:  940 9-9 PRI       FEEDER AMPS:     1 VOLTAGE DROP:    4. %VD:    .0
PROJECTED POWER FLOW:      16.7 KW       5.5 KVAR      17.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA


==== BUS:  940 9-9 PRI    DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13727 %VD: -4.0
======================== PU BUS VOLTAGE:  1.040       ANGLE:   -.1 DEGREES
              PROJECTED SPECIAL BUS LOAD:      16.7 KW       5.5 KVAR

LOAD FROM:  935 9-8 PRI       FEEDER AMPS:     1 VOLTAGE DROP:    4. %VD:    .0
PROJECTED POWER FLOW:      16.7 KW       5.5 KVAR      17.6 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA


==== BUS:  945 F949 L1    DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13712 %VD: -3.9
======================== PU BUS VOLTAGE:  1.039       ANGLE:   -.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:       4.7 KW       1.5 KVAR

LOAD FROM:  920 F940          FEEDER AMPS:    12 VOLTAGE DROP:    2. %VD:    .0
PROJECTED POWER FLOW:     271.3 KW      89.6 KVAR     285.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .1 KVA

LOAD   TO:  960 9-13 PRI      FEEDER AMPS:    12 VOLTAGE DROP:   14. %VD:    .1
PROJECTED POWER FLOW:     266.6 KW      88.0 KVAR     280.7 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW        .1 KVAR        .3 KVA
```

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

```
                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  960 9-13 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13699 %VD: -3.8
======================== PU BUS VOLTAGE:  1.038       ANGLE:    -.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:      19.2 KW      6.3 KVAR

LOAD FROM:  945 F949 L1      FEEDER AMPS:     12 VOLTAGE DROP:   14. %VD:   .1
PROJECTED POWER FLOW:     266.3 KW      87.9 KVAR     280.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW        .1 KVAR        .3 KVA

LOAD   TO:  963 9-14 PRI     FEEDER AMPS:     11 VOLTAGE DROP:   44. %VD:   .3
PROJECTED POWER FLOW:     247.1 KW      81.6 KVAR     260.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .8 KW        .4 KVAR        .8 KVA


==== BUS:  963 9-14 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13655 %VD: -3.4
======================== PU BUS VOLTAGE:  1.034       ANGLE:    -.4 DEGREES
              PROJECTED SPECIAL BUS LOAD:      19.1 KW      6.3 KVAR

LOAD FROM:  960 9-13 PRI     FEEDER AMPS:     11 VOLTAGE DROP:   44. %VD:   .3
PROJECTED POWER FLOW:     246.4 KW      81.2 KVAR     259.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .8 KW        .4 KVAR        .8 KVA

LOAD   TO:  966 9-15 PRI     FEEDER AMPS:     10 VOLTAGE DROP:   12. %VD:   .1
PROJECTED POWER FLOW:     227.3 KW      75.0 KVAR     239.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .1 KVAR        .2 KVA


==== BUS:  966 9-15 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13643 %VD: -3.4
======================== PU BUS VOLTAGE:  1.034       ANGLE:    -.4 DEGREES

LOAD FROM:  963 9-14 PRI     FEEDER AMPS:     10 VOLTAGE DROP:   12. %VD:   .1
PROJECTED POWER FLOW:     227.1 KW      74.9 KVAR     239.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .2 KW        .1 KVAR        .2 KVA

LOAD   TO:  969 SW UP        FEEDER AMPS:     10 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:     227.1 KW      74.9 KVAR     239.2 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW        .0 KVAR        .1 KVA
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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
******************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  969 SW UP      DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13640 %VD: -3.3
======================== PU BUS VOLTAGE:  1.033       ANGLE:   -.5 DEGREES

LOAD FROM:  966 9-15 PRI     FEEDER AMPS:    10 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:     227.1 KW     74.9 KVAR     239.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .1 KW       .0 KVAR        .1 KVA

LOAD   TO:  972 SW DOWN      FEEDER AMPS:    10 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     227.1 KW     74.9 KVAR     239.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA


==== BUS:  972 SW DOWN    DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13640 %VD: -3.3
======================== PU BUS VOLTAGE:  1.033       ANGLE:   -.5 DEGREES

LOAD FROM:  969 SW UP        FEEDER AMPS:    10 VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:     227.1 KW     74.9 KVAR     239.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA

LOAD   TO:  975 9-16 PRI     FEEDER AMPS:    10 VOLTAGE DROP:   45. %VD:   .3
PROJECTED POWER FLOW:     227.1 KW     74.9 KVAR     239.1 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .7 KW       .3 KVAR        .8 KVA


==== BUS:  975 9-16 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13595 %VD: -3.0
======================== PU BUS VOLTAGE:  1.030       ANGLE:   -.5 DEGREES

LOAD FROM:  972 SW DOWN      FEEDER AMPS:    10 VOLTAGE DROP:   45. %VD:   .3
PROJECTED POWER FLOW:     226.4 KW     74.5 KVAR     238.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .7 KW       .3 KVAR        .8 KVA

LOAD   TO:  980              FEEDER AMPS:    10 VOLTAGE DROP:   19. %VD:   .1
PROJECTED POWER FLOW:     226.4 KW     74.5 KVAR     238.3 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW       .1 KVAR        .3 KVA


==== BUS:  980            DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13577 %VD: -2.9
======================== PU BUS VOLTAGE:  1.029       ANGLE:   -.5 DEGREES

LOAD FROM:  975 9-16 PRI     FEEDER AMPS:    10 VOLTAGE DROP:   19. %VD:   .1
PROJECTED POWER FLOW:     226.1 KW     74.4 KVAR     238.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .3 KW       .1 KVAR        .3 KVA
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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
*****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


LOAD    TO:  983 9-25 PRI      FEEDER AMPS:     10 VOLTAGE DROP:   32. %VD:   .2
PROJECTED POWER FLOW:     226.1 KW      74.4 KVAR     238.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .5 KW        .2 KVAR        .6 KVA


==== BUS:  983 9-25 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13545 %VD: -2.6
======================== PU BUS VOLTAGE:  1.026        ANGLE:   -.5 DEGREES
              PROJECTED SPECIAL BUS LOAD:     164.8 KW      54.2 KVAR

LOAD FROM:  980                FEEDER AMPS:     10 VOLTAGE DROP:   32. %VD:   .2
PROJECTED POWER FLOW:     225.6 KW      74.1 KVAR     237.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .5 KW        .2 KVAR        .6 KVA

LOAD    TO:  984 9-25 SEC      TRANSF AMPS:        VOLTAGE DROP:    0. %VD:   .0
PROJECTED POWER FLOW:        .0 KW        .0 KVAR        .0 KVA  PF: .00 LEADING
LOSSES THRU TRANSF:      .0 KW       .0 KVAR       .0 KVA

LOAD    TO:  985 9-34 PRI      FEEDER AMPS:      3 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:      60.8 KW      20.0 KVAR      64.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA


==== BUS:  984 9-25 SEC   DESIGN VOLTAGE:    208  BUS VOLTAGE:   213 %VD: -2.6
======================== PU BUS VOLTAGE:  1.026        ANGLE:   -.5 DEGREES
**** NO LOAD SPECIFIED ****


==== BUS:  985 9-34 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13542 %VD: -2.6
======================== PU BUS VOLTAGE:  1.026        ANGLE:   -.5 DEGREES

LOAD FROM:  983 9-25 PRI       FEEDER AMPS:      3 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:      60.8 KW      20.0 KVAR      64.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA

LOAD    TO:  987               FEEDER AMPS:      3 VOLTAGE DROP:    9. %VD:   .1
PROJECTED POWER FLOW:      60.8 KW      20.0 KVAR      64.0 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW        .0 KVAR        .0 KVA
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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

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                BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS
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VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  987            DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13533 %VD: -2.5
======================== PU BUS VOLTAGE:  1.025        ANGLE:   -.5 DEGREES

LOAD FROM:  985 9-34 PRI    FEEDER AMPS:    3 VOLTAGE DROP:    9. %VD:   .1
PROJECTED POWER FLOW:     60.7 KW     20.0 KVAR     63.9 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  990 9-26 PRI    FEEDER AMPS:    2 VOLTAGE DROP:    8. %VD:   .1
PROJECTED POWER FLOW:     35.5 KW     11.7 KVAR     37.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  992             FEEDER AMPS:    1 VOLTAGE DROP:   16. %VD:   .1
PROJECTED POWER FLOW:     25.2 KW      8.3 KVAR     26.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  990 9-26 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13525 %VD: -2.5
======================== PU BUS VOLTAGE:  1.025        ANGLE:   -.5 DEGREES
              PROJECTED SPECIAL BUS LOAD:     35.5 KW     11.7 KVAR

LOAD FROM:  987             FEEDER AMPS:    2 VOLTAGE DROP:    8. %VD:   .1
PROJECTED POWER FLOW:     35.5 KW     11.7 KVAR     37.4 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA


==== BUS:  992            DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13517 %VD: -2.4
======================== PU BUS VOLTAGE:  1.024        ANGLE:   -.5 DEGREES

LOAD FROM:  987             FEEDER AMPS:    1 VOLTAGE DROP:   16. %VD:   .1
PROJECTED POWER FLOW:     25.1 KW      8.3 KVAR     26.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA

LOAD   TO:  997 9-32 PRI    FEEDER AMPS:    1 VOLTAGE DROP:    3. %VD:   .0
PROJECTED POWER FLOW:     25.1 KW      8.3 KVAR     26.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:         .0 KW       .0 KVAR       .0 KVA
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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

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*****************************************************************************
VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH =  4.00 %   BUS =  5.00


==== BUS:  997 9-32 PRI   DESIGN VOLTAGE: 13200  BUS VOLTAGE: 13514 %VD: -2.4
======================== PU BUS VOLTAGE:  1.024        ANGLE:    -.5 DEGREES
              PROJECTED SPECIAL BUS LOAD:      25.1 KW       8.3 KVAR

LOAD FROM:  992              FEEDER AMPS:     1 VOLTAGE DROP:     3. %VD:    .0
PROJECTED POWER FLOW:      25.1 KW      8.3 KVAR      26.5 KVA  PF: .95 LAGGING
LOSSES THRU FEEDER:          .0 KW       .0 KVAR        .0 KVA
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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BUS DATA SUMMARY
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BUS#	NAME	BASE VOLT	PU VOLT	BUS#	NAME	BASE VOLT	PU VOLT
10	GEN G1	2400.00	1.050	15	G1 STEP-UP	2400.00	1.050
20	GEN G2	2400.00	1.045	25	G2 STEP-UP	2400.00	1.045
30	GEN G3	2400.00	1.045	35	G3 STEP-UP	2400.00	1.045
40	GEN G4	4160.00	1.045	50	GEN G5	4160.00	1.045
60	SWGR S	4160.00	1.045	62	SS-1 SEC	480.00	1.045
64	MCC 4&5	480.00	1.045	66	SM1A BLUE	4160.00	1.045
68	BLUE SSS	480.00	1.045	70	SWGR N	4160.00	1.045
80	UTILITY	24900.00	1.000	85	T1 SEC	4160.00	1.045
90	SWGR O	4160.00	1.045	100	FDR 1	4160.00	1.044
105	F1F12 14	4160.00	1.043	110	F1 L14	4160.00	1.042
115	F1 L15	4160.00	1.042	120	F1 L31	4160.00	1.042
121	F1 L63	4160.00	1.041	122	F1 L64	4160.00	1.041
200	FDR 2	4160.00	1.044	205		4160.00	1.043
235	F5 F29	4160.00	1.043	236	F2 F211	4160.00	1.042
240	F1 F213	4160.00	1.042	300	FDR 3	4160.00	1.045
400	FDR 4	4160.00	1.045	500	FDR 5	4160.00	1.045
505	F4 F5 F6UF	4160.00	1.044	512	5-3 PRI	4160.00	1.044
515	F5 L24	4160.00	1.043	525	F5 L31	4160.00	1.043
531	F3 L41	4160.00	1.043	535	F537 L5	4160.00	1.043
555		4160.00	1.043	560	RICH SUB	4160.00	1.042
562	RS SEC	13200.00	1.040	565	5-17 PRI	4160.00	1.042
575	F5 51	4160.00	1.042	580	F5 L85	4160.00	1.042
600	O/H BUS	4160.00	1.045	700	FDR 7	4160.00	1.044
705	WELL9 POL	4160.00	1.044	707	7-1 SEC	480.00	1.044
709	F9 F73	4160.00	1.044	710	F7 L11	4160.00	1.044
715	F7 L13	4160.00	1.043	720	F713	4160.00	1.043
725	7-15 PRI	4160.00	1.043	735	F7 L54	4160.00	1.043
745		4160.00	1.043	750	F7 L72	4160.00	1.043
800	FDR 8	4160.00	1.045	900	FDR 9	4160.00	1.044
905	STEP SEC	13200.00	1.040	910	F 96	13200.00	1.040
915	F910	13200.00	1.040	920	F940	13200.00	1.039
925	()	13200.00	1.040	930	RICH SUB	13200.00	1.040
935	9-8 PRI	13200.00	1.040	940	9-9 PRI	13200.00	1.040
945	F949 L1	13200.00	1.039	960	9-13 PRI	13200.00	1.038
963	9-14 PRI	13200.00	1.034	966	9-15 PRI	13200.00	1.034
969	SW UP	13200.00	1.033	972	SW DOWN	13200.00	1.033
975	9-16 PRI	13200.00	1.030	980		13200.00	1.029
983	9-25 PRI	13200.00	1.026	984	9-25 SEC	208.00	1.026
985	9-34 PRI	13200.00	1.026	987		13200.00	1.025
990	9-26 PRI	13200.00	1.025	992		13200.00	1.024
997	9-32 PRI	13200.00	1.024				

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
10	GEN G1	15	G1 STEP-UP	FDR	.02	229.00	1000.00	49.25
15	G1 STEP-UP	10	GEN G1	FDR	.02	229.00	999.77	49.25
15	G1 STEP-UP	60	SWGR S	TX2	.57	229.00	999.77	UNKNOW
20	GEN G2	25	G2 STEP-UP	FDR	.00	.00	.00	.00
25	G2 STEP-UP	20	GEN G2	FDR	.00	.00	.00	.00
25	G2 STEP-UP	60	SWGR S	TX2	.00	.00	.00	UNKNOW
30	GEN G3	35	G3 STEP-UP	FDR	.00	.00	.00	.00
35	G3 STEP-UP	30	GEN G3	FDR	.00	.00	.00	.00
35	G3 STEP-UP	60	SWGR S	TX2	.00	.00	.00	UNKNOW
40	GEN G4	70	SWGR N	FDR	.00	.00	.00	.00
50	GEN G5	70	SWGR N	FDR	.00	.00	.00	.00
60	SWGR S	15	G1 STEP-UP	TX2	.57	132.12	994.33	UNKNOW
60	SWGR S	25	G2 STEP-UP	TX2	.00	.00	.00	UNKNOW
60	SWGR S	35	G3 STEP-UP	TX2	.00	.00	.00	UNKNOW
60	SWGR S	62	SS-1 SEC	TX2	.00	.01	.07	UNKNOW
60	SWGR S	66	SM1A BLUE	FDR	.00	.01	.10	.00
60	SWGR S	70	SWGR N	FDR	.00	74.85	563.32	16.10
60	SWGR S	100	FDR 1	FDR	.01	24.18	181.96	10.51
60	SWGR S	200	FDR 2	FDR	.01	33.49	252.04	14.56
60	SWGR S	300	FDR 3	FDR	.00	.00	.00	.00
60	SWGR S	400	FDR 4	FDR	.00	.00	.00	.00
60	SWGR S	500	FDR 5	FDR	.00	7.18	54.06	3.12
62	SS-1 SEC	60	SWGR S	TX2	.00	.08	.07	UNKNOW
62	SS-1 SEC	64	MCC 4&5	FDR	.00	.08	.07	.02
64	MCC 4&5	62	SS-1 SEC	FDR	.00	.08	.07	.02
64	MCC 4&5	68	BLUE SSS	FDR	.00	.12	.10	.03
64	MCC 4&5	90	SWGR O	TX2	.00	.20	.17	UNKNOW
66	SM1A BLUE	60	SWGR S	FDR	.00	.01	.10	.00
66	SM1A BLUE	68	BLUE SSS	TX2	.00	.01	.10	UNKNOW
68	BLUE SSS	64	MCC 4&5	FDR	.00	.12	.10	.03
68	BLUE SSS	66	SM1A BLUE	TX2	.00	.12	.10	UNKNOW
70	SWGR N	40	GEN G4	FDR	.00	.00	.00	.00
70	SWGR N	50	GEN G5	FDR	.00	.00	.00	.00
70	SWGR N	60	SWGR S	FDR	.00	74.85	563.32	16.10
70	SWGR N	90	SWGR O	FDR	.00	74.85	563.32	20.23
80	UTILITY	85	T1 SEC	TX2	4.45	8.40	362.22	UNKNOW
85	T1 SEC	80	UTILITY	TX2	4.45	47.76	359.44	UNKNOW
85	T1 SEC	90	SWGR O	FDR	.00	47.76	359.44	12.91
90	SWGR O	64	MCC 4&5	TX2	.00	.02	.17	UNKNOW
90	SWGR O	70	SWGR N	FDR	.00	74.85	563.31	20.23

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
90	SWGR O	85	T1 SEC	FDR	.00	47.76	359.43	12.91
90	SWGR O	600	O/H BUS	FDR	.00	.00	.00	.00
90	SWGR O	700	FDR 7	FDR	.01	29.75	223.88	12.93
90	SWGR O	800	FDR 8	FDR	.00	.00	.00	.00
90	SWGR O	900	FDR 9	FDR	.01	40.87	307.61	17.77
100	FDR 1	60	SWGR S	FDR	.01	24.18	181.95	10.51
100	FDR 1	105	F1F12 14	FDR	.19	24.18	181.95	6.77
105	F1F12 14	100	FDR 1	FDR	.19	24.18	181.63	6.77
105	F1F12 14	110	F1 L14	FDR	.02	24.18	181.63	6.77
110	F1 L14	105	F1F12 14	FDR	.02	24.18	181.59	6.77
110	F1 L14	115	F1 L15	FDR	.00	.00	.00	.00
110	F1 L14	120	F1 L31	FDR	.05	24.18	181.59	6.77
115	F1 L15	110	F1 L14	FDR	.00	.00	.00	.00
120	F1 L31	110	F1 L14	FDR	.05	24.18	181.50	6.77
120	F1 L31	121	F1 L63	FDR	.04	17.70	132.85	4.96
121	F1 L63	120	F1 L31	FDR	.04	17.70	132.80	4.96
121	F1 L63	122	F1 L64	FDR	.01	11.22	84.18	3.14
122	F1 L64	121	F1 L63	FDR	.01	11.22	84.17	3.14
200	FDR 2	60	SWGR S	FDR	.01	33.49	252.02	14.56
200	FDR 2	205		FDR	.10	33.49	252.02	9.38
205		200	FDR 2	FDR	.10	33.49	251.77	9.38
205		235	F5 F29	FDR	.07	33.49	251.77	9.38
235	F5 F29	205		FDR	.07	33.49	251.60	9.38
235	F5 F29	236	F2 F211	FDR	.03	26.81	201.40	7.51
236	F2 F211	235	F5 F29	FDR	.03	26.81	201.34	7.51
236	F2 F211	240	F1 F213	FDR	.02	13.40	100.66	3.75
240	F1 F213	236	F2 F211	FDR	.02	13.40	100.64	3.75
300	FDR 3	60	SWGR S	FDR	.00	.00	.00	.00
400	FDR 4	60	SWGR S	FDR	.00	.00	.00	.00
500	FDR 5	60	SWGR S	FDR	.00	7.18	54.06	3.12
500	FDR 5	505	F4 F5 F6UF	FDR	.02	7.18	54.06	2.01
505	F4 F5 F6UF	500	FDR 5	FDR	.02	7.18	54.04	2.01
505	F4 F5 F6UF	512	5-3 PRI	FDR	.06	7.18	54.04	2.01
512	5-3 PRI	505	F4 F5 F6UF	FDR	.06	7.18	54.01	2.01
512	5-3 PRI	515	F5 L24	FDR	.05	7.18	54.01	2.01
515	F5 L24	512	5-3 PRI	FDR	.05	7.18	53.99	2.01
515	F5 L24	525	F5 L31	FDR	.01	7.18	53.99	2.01
525	F5 L31	515	F5 L24	FDR	.01	7.18	53.99	2.01
525	F5 L31	531	F3 L41	FDR	.01	2.97	22.29	.83
525	F5 L31	535	F537 L5	FDR	.02	2.97	22.29	.83

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
531	F3 L41	525	F5 L31	FDR	.01	2.97	22.29	.83
531	F3 L41	535	F537 L5	FDR	.01	2.97	22.29	.83
535	F537 L5	525	F5 L31	FDR	.02	2.97	22.29	.83
535	F537 L5	531	F3 L41	FDR	.01	2.97	22.29	.83
535	F537 L5	555		FDR	.03	5.93	44.58	2.15
555		535	F537 L5	FDR	.03	5.93	44.56	2.15
555		560	RICH SUB	FDR	.09	3.91	29.35	1.42
555		565	5-17 PRI	FDR	.01	2.03	15.24	.73
560	RICH SUB	555		FDR	.09	3.91	29.32	1.42
560	RICH SUB	562	RS SEC	TX2	.12	3.91	29.32	UNKNOW
562	RS SEC	560	RICH SUB	TX2	.12	1.23	29.29	UNKNOW
562	RS SEC	930	RICH SUB	FDR	.00	1.23	29.29	.88
565	5-17 PRI	555		FDR	.01	2.03	15.24	.73
565	5-17 PRI	575	F5 51	FDR	.00	1.25	9.40	.45
575	F5 51	565	5-17 PRI	FDR	.00	1.25	9.40	.45
575	F5 51	580	F5 L85	FDR	.01	1.25	9.40	.45
580	F5 L85	575	F5 51	FDR	.01	1.25	9.39	.45
600	O/H BUS	90	SWGR O	FDR	.00	.00	.00	.00
700	FDR 7	90	SWGR O	FDR	.01	29.75	223.86	12.93
700	FDR 7	705	WELL9 POL	FDR	.01	29.75	223.86	8.33
705	WELL9 POL	700	FDR 7	FDR	.01	29.75	223.85	8.33
705	WELL9 POL	707	7-1 SEC	TX2	.00	.00	.00	UNKNOW
705	WELL9 POL	709	F9 F73	FDR	.02	23.47	176.59	6.57
707	7-1 SEC	705	WELL9 POL	TX2	.00	.00	.00	UNKNOW
709	F9 F73	705	WELL9 POL	FDR	.02	23.47	176.55	6.57
709	F9 F73	710	F7 L11	FDR	.06	10.82	81.40	3.03
710	F7 L11	709	F9 F73	FDR	.06	10.82	81.36	3.03
710	F7 L11	715	F7 L13	FDR	.01	3.21	24.11	.90
710	F7 L11	720	F713	FDR	.01	4.46	33.57	1.25
715	F7 L13	710	F7 L11	FDR	.01	3.21	24.10	.90
720	F713	710	F7 L11	FDR	.01	4.46	33.56	1.25
720	F713	725	7-15 PRI	FDR	.03	4.46	33.56	1.25
725	7-15 PRI	720	F713	FDR	.03	4.46	33.56	1.25
725	7-15 PRI	735	F7 L54	FDR	.01	4.46	33.56	1.25
735	F7 L54	725	7-15 PRI	FDR	.01	4.46	33.55	1.25
735	F7 L54	745		FDR	.01	3.20	24.08	.90
745		735	F7 L54	FDR	.01	3.20	24.08	.90
745		750	F7 L72	FDR	.01	3.20	24.08	.90
750	F7 L72	745		FDR	.01	3.20	24.08	.90
800	FDR 8	90	SWGR O	FDR	.00	.00	.00	.00

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
900	FDR 9	90	SWGR O	FDR	.01	40.87	307.58	17.77
900	FDR 9	905	STEP SEC	TX2	.43	40.87	307.58	UNKNOW
905	STEP SEC	900	FDR 9	TX2	.43	12.88	306.32	UNKNOW
905	STEP SEC	910	F 96	FDR	.01	12.88	306.32	3.61
910	F 96	905	STEP SEC	FDR	.01	12.88	306.28	3.61
910	F 96	915	F910	FDR	.02	12.03	286.00	3.37
915	F910	910	F 96	FDR	.02	12.03	285.96	3.37
915	F910	920	F940	FDR	.09	12.03	285.96	3.37
920	F940	915	F910	FDR	.09	12.03	285.72	3.37
920	F940	945	F949 L1	FDR	.02	12.03	285.72	3.37
925	()	930	RICH SUB	FDR	.01	1.23	29.28	.88
925	()	935	9-8 PRI	FDR	.01	1.23	29.28	1.17
930	RICH SUB	562	RS SEC	FDR	.00	1.23	29.29	.88
930	RICH SUB	925	()	FDR	.01	1.23	29.29	.88
935	9-8 PRI	925	()	FDR	.01	1.23	29.28	1.17
935	9-8 PRI	940	9-9 PRI	FDR	.03	.74	17.57	.70
940	9-9 PRI	935	9-8 PRI	FDR	.03	.74	17.56	.70
945	F949 L1	920	F940	FDR	.02	12.03	285.68	3.37
945	F949 L1	960	9-13 PRI	FDR	.10	11.82	280.73	6.42
960	9-13 PRI	945	F949 L1	FDR	.10	11.82	280.45	6.42
960	9-13 PRI	963	9-14 PRI	FDR	.33	10.97	260.26	5.96
963	9-14 PRI	960	9-13 PRI	FDR	.33	10.97	259.42	5.96
963	9-14 PRI	966	9-15 PRI	FDR	.09	10.12	239.36	5.50
966	9-15 PRI	963	9-14 PRI	FDR	.09	10.12	239.16	5.50
966	9-15 PRI	969	SW UP	FDR	.02	10.12	239.16	5.50
969	SW UP	966	9-15 PRI	FDR	.02	10.12	239.10	5.50
969	SW UP	972	SW DOWN	FDR	.00	10.12	239.10	2.18
972	SW DOWN	969	SW UP	FDR	.00	10.12	239.10	2.18
972	SW DOWN	975	9-16 PRI	FDR	.34	10.12	239.10	5.50
975	9-16 PRI	972	SW DOWN	FDR	.34	10.12	238.32	5.50
975	9-16 PRI	980		FDR	.14	10.12	238.32	5.50
980		975	9-16 PRI	FDR	.14	10.12	237.99	5.50
980		983	9-25 PRI	FDR	.24	10.12	237.99	5.50
983	9-25 PRI	980		FDR	.24	10.12	237.43	5.50
983	9-25 PRI	984	9-25 SEC	TX2	.00	.00	.00	UNKNOW
983	9-25 PRI	985	9-34 PRI	FDR	.02	2.73	63.97	1.48
984	9-25 SEC	983	9-25 PRI	TX2	.00	.00	.00	UNKNOW
985	9-34 PRI	983	9-25 PRI	FDR	.02	2.73	63.95	1.48
985	9-34 PRI	987		FDR	.07	2.73	63.95	1.48
987		985	9-34 PRI	FDR	.07	2.73	63.91	1.48

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY
****

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
987		990	9-26 PRI	FDR	.06	1.60	37.42	.87
987		992		FDR	.12	1.13	26.49	.61
990	9-26 PRI	987		FDR	.06	1.60	37.39	.87
992		987		FDR	.12	1.13	26.46	.61
992		997	9-32 PRI	FDR	.02	1.13	26.46	.61
997	9-32 PRI	992		FDR	.02	1.13	26.46	.61

NOTE: FOR FEEDERS, RATING% = LOAD FLOW AMPS / FLA.
FLA = LIBRARY FLA EXCLUDING DUCT BANK AND TEMP. DERATING FOR CABLES.
FLA = BRANCH RECORD INPUT FLA FOR IMPEDANCE DATA.

NOTE: FOR TRANSFORMERS, RATING% = LOAD FLOW KVA / TRANSFORMER FULL LOAD KVA.

81 BUSES

*** T O T A L S Y S T E M L O S S E S ***
11.2 KW 43.1 KVAR

WARNING STUDY CONTAINS 2 VOLTAGE CRITERIA VIOLATIONS
VIOLATIONS DENOTED BY ($) AT BUS AND BRANCH %VD LOCATIONS

APPENDIX J

Construction Cost Estimates

Fort Greely, AK(1995-1997 Study)
Energy Efficiency Study
Power Distribution
1995-1997 Study

Designed By: DM
Estimated By:

Prepared By: TCP

Preparation Date: 01/08/96
Effective Date of Pricing: 01/08/96

Sales Tax: 0.00%

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

U.S. Army Corps of Engineers
PROJECT GRLY-1: Fort Greely, AK(1995-1997 Study) - Energy Efficiency Study
Ft. Greely Electrical Study (1995-1997)
** PROJECT DIRECT SUMMARY - Scope **

	QUANTITY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST	UNIT COST
20 Site Electrical Utilities	1.00	EA	280,796	7,038	293,802	36,975	611,573	611573.10
TOTAL Fort Greely, AK(1995-1997 Study)	1.00	EA	280,796	7,038	293,802	36,975	611,573	611573.10
Contractor's Overhead							91,736	
SUBTOTAL							703,309	
Contractor's Profit							70,331	
SUBTOTAL							773,640	
Contractor's Bond							23,209	
TOTAL INCL INDIRECTS							796,849	
Escalation							31,874	
SUBTOTAL							828,723	
Contingency							165,745	
TOTAL INCL OWNER COSTS							994,468	

LABOR ID: FRBK94 EQUIP ID: ALASKA Currency in DOLLARS CREW ID: FRBK94 UPB ID: ANCH94

20.02. Exterior Electrical Distribution

		QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
20. Site Electrical Utilities								
20.02. Exterior Electrical Distribution								
20.02.01. Transformers								
M MIL AA <16121 1207 >	#4/0AWG Compr Lugs,1Hole,Wrapped Low Voltage - To 600 Volts Reconnect 1 single phase transformer.	76.00	EA	311	67	2,923	9	3,243
M MIL AA <16121 1207 >	#4/0AWG Compr Lugs,1Hole,Wrapped Low Voltage - To 600 Volts Represents (69) 3-phase transformers made up of 3 single phase transformers.	207.00	EA	847	182	7,962	24	8,833
M MIL AA <16330 4122 >	112.5KVA,Pri4160GrdY/-13800V,Sec 208Y/120,3 Ph,Oil Xfrmr,Pad Mtd	1.00	EA	7,837	27	1,197	29	9,063
M MIL AA <16330 4124 >	225 KVA,Pri4160GrdY/-13800V,Sec 208Y/120,3 Ph,Oil Xfrmr,Pad Mtd	1.00	EA	10,519	46	1,996	48	12,563
M MIL AA <16330 4126 >	500 KVA,Pri4160GrdY/-13800V,Sec 208Y/120,3 Ph,Oil Xfrmr,Pad Mtd	3.00	EA	47,521	246	10,777	261	58,559
	TOTAL Transformers			67,034	567	24,856	372	92,261
20.02.04. Towers, Poles, Crossarms & Insulators								
M MIL AA <16413 2102 >	3-1/2"x 4-1/2"x 8'0",Single Arm Wood Crossarm,w/Hardware &Braces	66.00	EA	1,356	113	4,673	831	6,859
M MIL AA <16413 4101 >	5KV Class 55-3,Pin Insul w/Pin	594.00	EA	3,962	759	31,258	5,559	40,779
M MIL AA <16413 4101 >	5KV Class 55-3,Pin Insul w/Pin	1318.00	EA	8,791	1,683	69,357	12,336	90,483
M MIL AA <16120 6008 >	#4/0 AWG ACRS Cable Penquin 6/1 Installed on Poles,Aluminum Cabl	163.70	MLF	85,525	2,858	117,122	15,071	217,718
USR AA < >	Step-up Transformer for Gen #1 Material price taken from Means Electrical Cost Data 1995, labor price taken from Richardson Cost Guide for Fairbanks.	1.00	EA	23,300	87	3,168	465	26,933
USR AA < >	Step-up Transformer for Gen #2 Material price taken from Means Electrical Cost Data 1995, labor rate taken from Richardson Cost Guide for Fairbanks.	1.00	EA	23,300	87	3,168	465	26,933
USR AA < >	Step-up Transformer for Gen #3 Material cost taken from Means Electrical Cost Data 1995, labor rates taken from Richardson Cost Guide for Fairbanks, AK.	1.00	EA	23,300	87	3,168	465	26,933
USR AA < >	Convert G4 to Wye	1.00	EA	100	16	583	0	683

20.02. Exterior Electrical Distribution		QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
USR AA < >	Convert G5 to Wye	1.00	EA	100	16	583	0	683
M MIL AA <16452 1001 >	1/2"Diax10'L Ground Rods,Cu-Clad	329.00	EA	3,668	422	18,496	56	22,221
M MIL AA <16453 1001 >	1/2",Ground Rod Clamp	329.00	EA	757	137	6,011	18	6,786
M MIL AA <16120 7105 >	#4 AWG 1/c Bare Strd Cu Cable Installed on Poles	16.47	MLF	4,603	206	8,446	1,087	14,136
USR AA < >	Vacuum Circuit Breaker	1.00	EA	35,000	0	2,915	250	38,165
	TOTAL Towers, Poles, Crossarms &			213,762	6,471	268,947	36,603	519,312
	TOTAL Exterior Electrical Distribution			280,796	7,038	293,802	36,975	611,573
	TOTAL Site Electrical Utilities			280,796	7,038	293,802	36,975	611,573
	TOTAL Fort Greely, AK(1995-1997 Study)			280,796	7,038	293,802	36,975	611,573

Fort Greely, AK(Post 2001 Study)
Energy Efficiency Study
Power Distribution
Post 2001 Study

Designed By: DM
Estimated By:

Prepared By: TCP

Preparation Date: 01/08/96
Effective Date of Pricing: 01/08/96

Sales Tax: 0.00%

M C A C E S G O L D E D I T I O N
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Release 5.30

LABOR ID: FRBK94 EQUIP ID: ALASKA

Currency in DOLLARS

CREW ID: FRBK94 UPB ID: ANCH94

SUMMARY REPORTS — SUMMARY PAGE

DETAILED ESTIMATE — DETAIL PAGE

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

U.S. Army Corps of Engineers
PROJECT GRLY-2: Fort Greely, AK(Post 2001 Study) - Energy Efficiency Study
Ft. Greely Electrical Study (Post 2001)
** PROJECT DIRECT SUMMARY - Scope **

	QUANTITY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST	UNIT COST
20 Site Electrical Utilities	1.00	EA	201,734	5,035	209,758	27,646	439,137	439137.36
TOTAL Fort Greely, AK(Post 2001 Study)	1.00	EA	201,734	5,035	209,758	27,646	439,137	439137.36
Contractor's Overhead							65,871	
SUBTOTAL							505,008	
Contractor's Profit							50,501	
SUBTOTAL							555,509	
Contractor's Bond							16,665	
TOTAL INCL INDIRECTS							572,174	
Escalation							22,887	
SUBTOTAL							595,061	
Contingency							119,012	
TOTAL INCL OWNER COSTS							714,073	

20.02. Exterior Electrical Distribution

		QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
USR AA <	> Convert G4 to Wye	1.00	EA	100	16	583	0	683
USR AA <	> Convert G5 to Wye	1.00	EA	100	16	583	0	683
M MIL AA <16452 1001	> 1/2"Diax10'L Ground Rods,Cu-Clad	244.00	EA	2,721	313	13,717	42	16,480
M MIL AA <16453 1001	> 1/2",Ground Rod Clamp	244.00	EA	561	102	4,458	14	5,033
M MIL AA <16120 7105	> #4 AWG 1/c Bare Strd Cu Cable Installed on Poles	12.20	MLF	3,410	153	6,256	805	10,471
USR AA <	> Vacuum Circuit Breaker	1.00	EA	35,000	0	2,915	250	38,165
	TOTAL Towers, Poles, Crossarms &			185,668	4,872	202,857	27,552	416,077
	TOTAL Exterior Electrical Distribution			201,734	5,035	209,758	27,646	439,137
	TOTAL Site Electrical Utilities			201,734	5,035	209,758	27,646	439,137
	TOTAL Fort Greely, AK(Post 2001 Study)			201,734	5,035	209,758	27,646	439,137

20.02. Exterior Electrical Distribution

		QUANTY UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
20. Site Electrical Utilities							
20.02. Exterior Electrical Distribution							
20.02.01. Transformers							
M MIL AA <16121 1207 >	#4/0AWG Compr Lugs,1Hole,Wrapped Low Voltage - To 600 Volts Reconnect 1 single phase transformer.	4.00 EA	16	4	154	0	171
M MIL AA <16121 1207 >	#4/0AWG Compr Lugs,1Hole,Wrapped Low Voltage - To 600 Volts Represents (17) 3-phase transformers made up of 3 single phase transformers.	51.00 EA	209	45	1,962	6	2,176
M MIL AA <16330 4126 >	500 KVA,Pri4160GrdY/-13800V,Sec 208Y/120,3 Ph,Oil Xfrmr,Pad Mtd	1.00 EA	15,840	83	3,629	88	19,557
USR AA < >	Disconnect Existing Transformer Assume 15 min/transformer at labor rate taken from Richardson Cost Estimating Guide for Fairbanks.	127.00 EA	0	32	1,157	0	1,157
	TOTAL Transformers		16,065	163	6,901	94	23,061
20.02.04. Towers, Poles, Crossarms & Insulators							
M MIL AA <16413 2102 >	3-1/2"x 4-1/2"x 8'0",Single Arm Wood Crossarm,w/Hardware &Braces	49.00 EA	1,006	84	3,469	617	5,092
M MIL AA <16413 4101 >	5KV Class 55-3,Pin Insul w/Pin	440.00 EA	2,935	562	23,154	4,118	30,207
M MIL AA <16413 4101 >	5KV Class 55-3,Pin Insul w/Pin	976.00 EA	6,510	1,246	51,360	9,135	67,004
M MIL AA <16120 6008 >	#4/0 AWG ACRS Cable Penquin 6/1 Installed on Poles,Aluminum Cabl	121.40 MLF	63,425	2,119	86,858	11,176	161,459
USR AA < >	Step-up Transformer for Gen #1 Material price taken from Means Electrical Cost Data 1995, labor price taken from Richardson Cost Guide for Fairbanks.	1.00 EA	23,300	87	3,168	465	26,933
USR AA < >	Step-up Transformer for Gen #2 Material price taken from Means Electrical Cost Data 1995, labor rate taken from Richardson Cost Guide for Fairbanks.	1.00 EA	23,300	87	3,168	465	26,933
USR AA < >	Step-up Transformer for Gen #3 Material cost taken from Means Electrical Cost Data 1995, labor rates taken from Richardson Cost Guide for Fairbanks, AK.	1.00 EA	23,300	87	3,168	465	26,933

APPENDIX K

LCCA and Economic Analysis

ENERGY USAGE AND COST PROVIDED TO FT. GREELY BY GVEA

Month	1 (FGR) TOTAL kWh Received @ Ft. Greely	2 (FWO) Ft. Wain. Output to GVEA	3 (WE) Ft. Wain. Wheeled to Ft. Greely	4 (PE) Ft. Greely kWh Rec'd. from GVEA	5 (EC) Cost of Electricity from GVEA	6 (WC) Cost of Wheeling to Ft. Greely	7 (D) Demand kW	8 (DC) Demand Charge	9 (MC) Misc.	10 (TC) Resulting Billing
Sep-93	1,249,440	1,411,310	1,254,655	(5,215)	$0	$16,829	2,424	$15,150	$55	$32,034
Oct-93	1,396,800	1,493,260	1,327,508	69,292	$5,552	$17,803	2,736	$17,100	($1,323)	$39,132
Nov-93	1,531,680	1,168,380	1,038,690	492,990	$37,668	$13,941	2,904	$18,150	($9,748)	$60,011
Dec-93	1,591,680	1,145,270	1,018,145	573,535	$43,773	$13,667	2,904	$18,150	($10,825)	$64,765
Jan-94	1,563,840	1,843,700	1,639,049	(75,209)	$0	$21,969	2,976	$18,600	$55	$40,624
Feb-94	1,483,920	1,423,250	1,265,269	218,651	$16,873	$16,971	2,904	$18,150	($4,103)	$47,891
Mar-94	1,572,000	1,322,760	1,175,934	396,066	$30,321	$15,776	2,784	$17,400	($7,134)	$56,363
Apr-94	1,365,600	1,201,590	1,068,214	297,386	$22,841	$14,336	2,688	$16,800	($6,317)	$47,660
May-94	1,214,400	1,326,000	1,178,814	35,586	$2,997	$15,815	2,544	$15,900	($1,514)	$33,198
Jun-94	1,116,000	984,850	875,532	240,468	$18,527	$11,760	2,256	$14,100	($5,279)	$39,107
Jul-94	1,092,000	967,630	860,223	231,777	$17,868	$11,555	2,184	$13,650	($4,963)	$38,110
Aug-94	1,140,000	1,251,190	1,112,308	27,692	$2,398	$14,926	2,280	$14,250	($1,663)	$29,911
TOTAL	**16,317,360**	**15,539,190**	**13,814,340**	**2,503,020**	**$198,818**	**$185,347**	**31,584**	**$197,400**	**($52,759)**	**$528,806**

1. Total kWhs into Ft. Greely read at the Ft. Greely meter = FGR
2. kWh output from Ft. Wainwright Power Plant to GVEA measured at the Ft. Wainwright meter = FWO
3. Amount of electricity wheeled to Ft. Greely from Ft. Wainwright less 11.1% line losses = WE = FWO X 0.889
4. Ft. Greely purchased electricity from GVEA = PE = FGR - WE
5. Cost of electricity purchased from GVEA based on the GVEA GS-2 rate schedule = EC = 500 X .1136 + 4500 X .099 + 10000 X .0934 + (PE - 15000) X .0758. If PE < 0, then EC = 0.
6. Cost of wheeling electricity from Ft. Wainwright to Ft. Greely at 17.64% of the GVEA GS-2 rate schedule = WC = (500 X .1136 + 4500 X .099 + 10000 X .0934 + (WE - 15000) X .0758) X .1764
7. Peak monthly demand recorded at Ft. Greely meter.
8. Demand charge = DC = D X 6.25
9. Miscellaneous adjustments account for customer charge, power adjustment, late charges, & regulatory charges.
10. Total billing is the sum of all charges = TC= EC + WC + DC + MC

11.Cost electric of power from GVEA:	Energy Only =	$0.0584	per kWh
= (EC + MC) / PE	Demand Only =	$ 6.25	per kW-month
12.Cost of electric power from GVEA:	Demand & Energy =	$0.1372	pe kWh
(with demand charge incorporated into the energy rate)			
= (TC - WC) / PE			
13.Cost of electric power wheeled	Wheeling Cost =	$0.0134	per kWh
from Fort Wainwright:	Generation Cost =	$0.0600	per kWh
= WC / WE + 0.06	Total Cost =	$0.0734	per kWh
14.Weighted cost of electric power:	Energy Only =	$0.0711	per kWh
(considering both sources)	Demand Only =	$ 6.25	per kW-month
= (PE / FGR) X (#11 or #12) + (WE / FGR) X (#13)	Demand & Energy =	$0.0832	per kWh

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET – BOX 71249

FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft. Greely AK 99703

DATE OCTOBER 7, 1993

ACCOUNT NO: 010-4410-00

REGARDING Ft. Greely In from GVEA

BILLING PERIOD SEPTEMBER 1993

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS.	TRUE CALC. CONS	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
7175	2400	7909.7	7389.1		520.6			1,249,440			
	DEMAND				1.01			2,424			
70197	10	871,963	730,832		141,131			1,411,310			
FWO – 11.1% = WE		156,655						1,254,655			
FORT GREELY KWH RECEIVED								1,249,440			
FORT WAINWRIGHT ADJUSTED OUTPUT								1,254,655			
PURCHASED ELECTRICITY								(5,215)			

POWER PURCHASE COSTS

CUSTOMER CHARGE		40.00
0 KWH @	0.1136	0.00
0 KWH @	0.0990	0.00
0 KWH @	0.0934	0.00
0 KWH @	0.0758	0.00
COST OF POWER ADJUSTMENT	0.02027 PER/KWH	0.00
POWER WHEELED		16,828.93
DEMAND	2424 KW @ $6.25	15,150.00
LATE CHARGE		15.00
REGULATORY CHARGES @	0.000626 CENTS/KWH	0.00
TOTAL BILL		$2,033.93

THIS INVOICE DUE AND PAYABLE 20 DAYS FROM ABOVE DATE

BILL AND DEMAND TOTAL $

SURCHARGE OR DISCOUNT $

CONNECTING CHARGE DETAIL $

PENALTY TOTAL $		NET TOTAL	$32,033.93
ADD TAX $		ADD TAX	
PENALTY AMOUNT DUE $		ARREARS	$66,872.94
		NET AMOUNT DUE	$98,906.87

(See contract for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY ______________________

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET – BOX 71249

FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft. Greely AK 99703

DATE OCTOBER 7, 1993

ACCOUNT NO: 010-4410-00

REGARDING Ft. Greely In from GVEA

BILLING PERIOD OCTOBERS 1993

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS	TRUE CALC. CONS	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
7175	2400	8491.7	7909.7		582			1,396,800			
	DEMAND				1.14			2,736			
70197	10	1,021,289	871,963		149,326			1,493,260			
FWO – 11.1% = WE		165,752						1,327,508			
FORT GREELY KWH RECEIVED								1,396,800			
FORT WAINWRIGHT ADJUSTED OUTPUT								1,327,508			
PURCHASED ELECTRICITY								69,292			
	POWER PURCHASE COSTS										
		CUSTOMER CHARGE						40.00			
		500 KWH @	0.1136					56.80			
		4500 KWH @	0.0990					445.50			
		10,000 KWH @	0.0934					934.00			
		54,292 KWH @	0.0758					4,115.32			
COST OF POWER ADJUSTMENT			0.02027 PER/KWH					(1,404.55)			
POWER WHEELED								17,803.07			
DEMAND	2736 KW @ $6.25							17,100.00			
LATE CHARGE								15.00			
REGULATORY CHARGES @		0.000386 CENTS/KWH						26.75			
				TOTAL BILL				39,131.89			

THIS INVOICE DUE AND PAYABLE 20 DAYS FROM ABOVE DATE

BILL AND DEMAND TOTAL $

SURCHARGE OR DISCOUNT $

CONNECTING CHARGE DETAIL $

NET TOTAL $39,131.89

PENALTY TOTAL $

ADD TAX

ADD TAX $

ARREARS $98,906.87

PENALTY AMOUNT DUE $

NET AMOUNT DUE $138,038.76

(See contract for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY ______________________

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET – BOX 71249

FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft. Greely AK 99703

DATE DECEMBER 7,1993

ACCOUNT NO: 010-4410-00

REGARDING Ft. Greely in from GVEA

BILLING PERIOD NOVEMBER 1993

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS.	TRUE CALC. CONS	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
7175	2400	9129.9	8491.7		638.2			1,531,680			
	DEMAND				1.21			2,904			
70197	10	138,127	21,289		116,838			1,168,380			
FWO – 11.1% = WE		129,690						1,038,690			
FORT GREELY KWH RECEIVED								1,531,680			
FORT WAINWRIGHT ADJUSTED OUTPUT								1,038,690			
PURCHASED ELECTRICITY								492,990			
POWER PURCHASE COSTS											
CUSTOMER CHARGE								40.00			
500 KWH @			0.1136					56.80			
4500 KWH @			0.0990					445.50			
10,000 KWH @			0.0934					934.00			
477,990 KWH @			0.0758					36,231.66			
COST OF POWER ADJUSTMENT			0.02027 PER/KWH					(9,992.91)			
POWER WHEELED								13,941.24			
DEMAND	2904 KW @ $6.25							18,150.00			
LATE CHARGE								15.00			
REGULATORY CHARGES @		0.000386 CENTS/KWH						190.29			
				TOTAL BILL				60,011.58			

THIS INVOICE DUE AND PAYABLE 20 DAYS FROM ABOVE DATE

BILL AND DEMAND TOTAL $

SURCHARGE OR DISCOUNT $

CONNECTING CHARGE DETAIL $

		NET TOTAL	$60,011.58
PENALTY TOTAL	$	ADD TAX	
ADD TAX	$	ARREARS	$30,131.89
PENALTY AMOUNT DUE	$	NET AMOUNT DUE	$90,143.47

(See contract for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY ______________________

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET – BOX 71249
FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft. Greely AK 99703

DATE JANUARY 7, 1994

ACCOUNT NO: 010-4410-00

REGARDING Ft. Greely in from GVEA

BILLING PERIOD DECEMBER 1993

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS.	TRUE CALC. CONS	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
7175	2400	9793.1	9129.9		663.2			1,591,680			
	DEMAND				1.21			2,904			
70197	10	252,654	138,127		114,527			1,145,270			
FWO – 11.1% = WE		127,125						1,018,145			
FORT GREELY KWH RECEIVED								1,591,680			
FORT WAINWRIGHT ADJUSTED OUTPUT								1,018,145			
PURCHASED ELECTRICITY								573,535			
	POWER PURCHASE COSTS										
		CUSTOMER CHARGE						40.00			
		500 KWH @	0.1136					56.80			
		4500 KWH @	0.0990					445.50			
		10,000 KWH @	0.0934					934.00			
		558,535 KWH @	0.0758					42,336.95			
COST OF POWER ADJUSTMENT			0.01933 PER/KWH					(11,086.43)			
POWER WHEELED								13,666.54			
DEMAND		2904 KW @ $6.25						18,150.00			
LATE CHARGE								0.00			
REGULATORY CHARGES @		0.000386 CENTS/KWH						221.36			
					TOTAL BILL			64,764.74			

THIS INVOICE DUE AND PAYABLE 20 DAYS FROM ABOVE DATE

BILL AND DEMAND TOTAL $

SURCHARGE OR DISCOUNT $

CONNECTING CHARGE DETAIL $

NET TOTAL $64,764.74

PENALTY TOTAL $

ADD TAX

ADD TAX $

ARREARS $0.00

PENALTY AMOUNT DUE $

NET AMOUNT DUE $64,764.74

(See contract for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY ____________________

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

756 ILLINOIS STREET – BOX 71249

FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft. Greely AK 99703

DATE FEBRUARY 2, 1994

ACCOUNT NO: 010–4410–00

REGARDING Ft. Greely In from GVEA

BILLING PERIOD JANUARY 1994

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS	TRUE CALC. CONS	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
7175	2400	10444.7	9793.1		651.6			1,563,840		DEMAI	
	DEMAND				1.24			2,976			
70197	10	437,024	252,654		184,370			1,843,700			
FWO – 11.1% = WE		204,651						1,639,049			
FORT GREELY KWH RECEIVED								1,563,840			
FORT WAINWRIGHT ADJUSTED OUTPUT								1,639,049			
PURCHASED ELECTRICITY								(75,209)			
POWER PURCHASE COSTS											
CUSTOMER CHARGE								40.00			
0 KWH @			0.1136					0.00			
0 KWH @			0.0990					0.00			
0 KWH @			0.0934					0.00			
0 KWH @			0.0758					0.00			
COST OF POWER ADJUSTMENT			0.01933 PER/KWH					0.00			
POWER WHEELED								21,968.72			
DEMAND	2976 KW @ $6.25							18,600.00			
LATE CHARGE								15.00			
REGULATORY CHARGES @		0.000386 CENTS/KWH						0.00			
				TOTAL BILL				40,623.72			

THIS INVOICE DUE AND PAYABLE 20 DAYS FROM ABOVE DATE

BILL AND DEMAND TOTAL $

SURCHARGE OR DISCOUNT $

CONNECTING CHARGE DETAIL $

NET TOTAL $40,623.72

PENALTY TOTAL $

ADD TAX

ADD TAX $

ARREARS $64,764.74

PENALTY AMOUNT DUE $

NET AMOUNT DUE $105,388.46

(See contract for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY ______________________

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET – BOX 71249

FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft. Greely AK 99703

DATE MARCH 8,1994

ACCOUNT NO: 010–4410–00

REGARDING Ft. Greely In from GVEA

BILLING PERIOD FEBRUARY 1994

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS	TRUE CALC. CONS	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
7176	2400	1063	444.7		618.3			1,483,920			
	DEMAND				1.21			2,904			
70197	10	579,949	437,024		142,925			1,423,250			
FWO – 11.1% = WE		157,981						1,265,269			
FORT GREELY KWH RECEIVED								1,483,920			
FORT WAINWRIGHT ADJUSTED OUTPUT								1,265,269			
PURCHASED ELECTRICITY								218,651			
	POWER PURCHASE COSTS										
		CUSTOMER CHARGE						40.00			
		500 KWH @	0.1136					56.80			
		4500 KWH @	0.0990					445.50			
		10,000 KWH @	0.0934					934.00			
		203,651 KWH @	0.0758					15,436.73			
COST OF POWER ADJUSTMENT			0.01933 PER/KWH					(4,226.52)			
POWER WHEELED								16,970.86			
DEMAND		2904 KW @ $6.25						18,150.00			
LATE CHARGE								0.00			
REGULATORY CHARGES @		0.000386 CENTS/KWH						84.40			
				TOTAL BILL				47,891.77			

THIS INVOICE DUE AND PAYABLE 30 DAYS FROM ABOVE DATE

BILL AND DEMAND TOTAL $

SURCHARGE OR DISCOUNT $

CONNECTING CHARGE DETAIL $

NET TOTAL $47,891.77

PENALTY TOTAL $

ADD TAX

ADD TAX $

ARREARS $0.00

PENALTY AMOUNT DUE $

NET AMOUNT DUE $47,891.77

(See contract for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY ______________________

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET – BOX 71249

FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft. Greely AK 99703

DATE APRIL 6, 1994

ACCOUNT NO: 010–4410–00

REGARDING Ft. Greely In from GVEA

BILLING PERIOD MARCH 1994

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS.	TRUE CALC. CONS	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
7175	2400	1522	1063		459			1,101,600			
70976	2400	196	0 meter change		196			470,400			
	DEMAND				1.16			2,784			
70197	10	711,625	579,349		132,276			1,322,760			
FWO – 11.1% = WE		146,826						1,175,934			
FORT GREELY KWH RECEIVED								1,572,000			
FORT WAINWRIGHT ADJUSTED OUTPUT								1,175,934			
PURCHASED ELECTRICITY								396,066			
	POWER PURCHASE COSTS										
		CUSTOMER CHARGE						40.00			
		500 KWH @	0.1136					56.80			
		4500 KWH @	0.0990					445.50			
		10,000 KWH @	0.0934					934.00			
		381,066 KWH @	0.0756					28,884.63			
COST OF POWER ADJUSTMENT			0.0185 PER/KWH					(7,327.23)			
POWER WHEELED								15,776.35			
DEMAND		2784 KW @ $6.25						17,400.00			
LATE CHARGE								0.00			
REGULATORY CHARGES @		0.000386 CENTS/KWH						152.66			
				TOTAL BILL				56,363.13			

THIS INVOICE DUE AND PAYABLE 20 DAYS FROM ABOVE DATE

BILL AND DEMAND TOTAL $

SURCHARGE OR DISCOUNT $

CONNECTING CHARGE DETAIL $

NET TOTAL $56,363.13

PENALTY TOTAL $

ADD TAX

ADD TAX $

ARREARS $0.00

PENALTY AMOUNT DUE $

NET AMOUNT DUE $56,363.13

(See contract for penalty information)

CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND
THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY ______________________

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET – BOX 71249
FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft Greely AK 99703

DATE MAY 4, 1994

ACCOUNT NO: 010-4410-00

REGARDING Ft. Greely in from GVEA

BILLING PERIOD APRIL 1994

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS	TRUE CALC. CONS	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
70976	2400	765	196		569			1,365,600			
	DEMAND				1.12			2,688			
70197	10	831,784	711,625		120,159		1,201,590				
FWO > 120% OF FT. GREELY DEMAND							43,655	1,157,735			
FWO – 11.1% = WE		128,509						1,029,226			
FORT GREELY KWH RECEIVED								1,365,600			
FORT WAINWRIGHT ADJUSTED OUTPUT								1,029,226			
PURCHASED ELECTRICITY								336,374			
POWER PURCHASE COSTS											
CUSTOMER CHARGE								40.00			
500 KWH @			0.1136					56.80			
4500 KWH @			0.0990					445.50			
10,000 KWH @			0.0934					934.00			
321,374 KWH @			0.0758					24,360.12			
COST OF POWER ADJUSTMENT			0.01933 PER/KWH					(6,502.10)			
POWER WHEELED								13,814.71			
DEMAND	2688 KW @ $6.25							16,800.00			
LATE CHARGE								15.00			
REGULATORY CHARGES @		0.000386 CENTS/KWH						129.84			
			TOTAL BILL					50,093.86			

THIS INVOICE DUE AND PAYABLE 20 DAYS FROM ABOVE DATE

BILL AND DEMAND TOTAL $

SURCHARGE OR DISCOUNT $

CONNECTING CHARGE DETAIL $

NET TOTAL $50,093.86

PENALTY TOTAL $

ADD TAX

ADD TAX $

ARREARS $56,362.83

PENALTY AMOUNT DUE $

NET AMOUNT DUE $106,456.69

(See reverse for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY ____________________

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET – BOX 71249
FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft. Greely AK 99703

DATE JUNE 6, 1994

ACCOUNT NO: 010-4410-00

REGARDING Ft. Greely in from GVEA

BILLING PERIOD MAY 1994

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS.	TRUE CALC. CONS	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
70976	2400	1271 ✓	765 ✓		506 ✓			1,214,400 ✓			
	DEMAND				1.06			2,544 ✓			
70197	10	964,364 ✓	831,764 ✓		132,600 ✓		1,326,000 ✓				
FWO > 120% OF FT. GREELY DEMAND							63,153	1,272,647 ✓			
FWO – 11.1% = WE		141,266 ✓						1,131,561 ✓			
FORT GREELY KWH RECEIVED								1,214,400 ✓			
FORT WAINWRIGHT ADJUSTED OUTPUT								1,131,561 ✓			
PURCHASED ELECTRICITY								82,839 ✓			
POWER PURCHASE COSTS											
CUSTOMER CHARGE								40.00 ✓			
		500 KWH @	0.1136					56.80 ✓			
		4500 KWH @	0.0990					445.50 ✓			
		10,000 KWH @	0.0934					934.00 ✓			
		67,839 KWH @	0.0758					5,142.20 ✓			
COST OF POWER ADJUSTMENT			0.01933 PER/KWH					(1,601.26) ✓			
POWER WHEELED								15,183.03 ✓			
DEMAND	2544 KW @ $6.25							15,900.00 ✓			
LATE CHARGE								15.00 ✓			
REGULATORY CHARGES @		0.000386 CENTS/KWH						31.98 ✓			
				TOTAL BILL				36,147.23 ✓			

THIS INVOICE DUE AND PAYABLE 20 DAYS FROM ABOVE DATE

BILL AND DEMAND TOTAL $

SURCHARGE OR DISCOUNT $

CONNECTING CHARGE DETAIL $

NET TOTAL $36,147.23

PENALTY TOTAL $

ADD TAX

ADD TAX $

ARREARS $50,093.57

PENALTY AMOUNT DUE $

NET AMOUNT DUE $86,240.80

(see contract for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND
THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY ____________________

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET – BOX 71249

FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft. Greely AK 99703

DATE JULY 5, 1994

ACCOUNT NO: 010–4410–00

REGARDING Ft. Greely In from GVEA

BILLING PERIOD JUNE 1994

CONTRACT NUMBER: DAHC76–92–C–0009

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS	TRUE CALC. CONS	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
70976	2400	1736	1271		465			1,116,000			
	DEMAND				0.94			2,256			
70197	10	1,062,869	964,384		98,485		984,650				
FWO > 120% OF FT. GREELY DEMAND							40,020	944,630			
FWO – 11.1% = WE		104,676						839,954			
FORT GREELY KWH RECEIVED								1,116,000			
FORT WAINWRIGHT ADJUSTED OUTPUT								839,954			
PURCHASED ELECTRICITY								276,046			
POWER PURCHASE COSTS											
CUSTOMER CHARGE								40.00			
	500 KWH @		0.1136					56.80			
	4500 KWH @		0.0990					445.50			
	10,000 KWH @		0.0934					934.00			
	261,046 KWH @		0.0758					19,787.30			
COST OF POWER ADJUSTMENT			0.01971 PER/KWH					(5,440.87)			
POWER WHEELED								11,263.92			
DEMAND	2256 KW @ $6.25							14,100.00			
LATE CHARGE								15.00			
REGULATORY CHARGES @		0.000386 CENTS/KWH						106.55			
				TOTAL BILL				41,328.20			

THIS INVOICE DUE AND PAYABLE 20 DAYS FROM ABOVE DATE

BILL AND DEMAND TOTAL $

SURCHARGE OR DISCOUNT $

CONNECTING CHARGE DETAIL $

		NET TOTAL	$41,328.20
PENALTY TOTAL	$	ADD TAX	
ADD TAX	$	ARREARS	$86,240.80
PENALTY AMOUNT DUE	$	NET AMOUNT DUE	$127,569.00

(See statement for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY ____________________

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET – BOX 71249
FAIRBANKS, ALASKA

SOLD TO: DIRECTORATE OF PUBLIC WORKS
1060 GAFFNEY BLVD.#6500
ATTN: APVR – FW – PW – 0
POWER PLANT
FT. WAINWRIGHT, AK 99703–6500

DATE August 4,1994

ACCOUNT NO: 010–4410–00

REGARDING Ft. Greely In from GVEA

BILLING PERIOD JULY 1994

CONTRACT NUMBER: DAHC76–92–C–0009

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS	TRUE CALC. CONS	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
70976	2400	2191	1736		455			1,092,000			
	DEMAND				0.91			2,184			
70197	10	150,632	62,869		86,763		967,630				
FWO > 120% OF FT. GREELY DEMAND							81,368	936,262			
FWO – 11.1% = WE		103,925						832,337			

FORT GREELY KWH RECEIVED		1,092,000
FORT WAINWRIGHT ADJUSTED OUTPUT		832,337
PURCHASED ELECTRICITY		259,663
POWER PURCHASE COSTS		
CUSTOMER CHARGE		40.00
500 KWH @	0.1136	56.80
4500 KWH @	0.0990	445.50
10,000 KWH @	0.0934	934.00
244,663 KWH @	0.0758	18,545.46
COST OF POWER ADJUSTMENT	0.01971 PER/KWH	(5,117.96)
POWER WHEELED		11,182.07
DEMAND	2184 KW @ $6.25	13,650.00
LATE CHARGE		15.00
REGULATORY CHARGES @	0.000386 CENTS/KWH	100.23
TOTAL BILL		$30,851.11

THIS INVOICE DUE AND PAYABLE 20 DAYS FROM ABOVE DATE

BILL AND DEMAND TOTAL $

SURCHARGE OR DISCOUNT $

CONNECTING CHARGE DETAIL $

NET TOTAL $30,851.11

PENALTY TOTAL $

ADD TAX

ADD TAX $

ARREARS $50,093.57

PENALTY AMOUNT DUE $

NET AMOUNT DUE $80,944.68

(See contract for penalty information)

RTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND
AT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY ____________________

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET – BOX 71249
FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft. Greely AK 99703

DATE September 1, 1994

ACCOUNT NO: 010–4410–00

ACTUAL

(no charge)

REGARDING Ft. Greely in from GVEA

BILLING PERIOD AUGUST 1994

CONTRACT NUMBER: DAHC76–92–C–0000

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS	TRUE CALC. CONS	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
70976	2400	2666	2191		475			1,140,000			
	DEMAND				0.95			2,280			
70197	10	284,751	159,632		125,119		1,251,190				
FWO > 120% OF FT. GREELY DEMAND							68,863	1,182,327			
FWO – 11.1% = WE		131,238						1,051,089			
FORT GREELY KWH RECEIVED								1,140,000			
FORT WAINWRIGHT ADJUSTED OUTPUT								1,051,089			
PURCHASED ELECTRICITY								88,911			
	POWER PURCHASE COSTS										
		CUSTOMER CHARGE						40.00			
		500 KWH @	0.1136					56.80			
		4500 KWH @	0.0990					445.50			
		10,000 KWH @	0.0934					934.00			
		73,911 KWH @	0.0758					5,602.48			
COST OF POWER ADJUSTMENT			0.01971 PER/KWH					(1,752.44)			
POWER WHEELED								14,107.03			
DEMAND	2280 KW @ $6.25							14,250.00			
LATE CHARGE								15.00			
REGULATORY CHARGES @		0.000366 CENTS/KWH						34.32			
					TOTAL BILL			33,732.68			

THIS INVOICE DUE AND PAYABLE 20 DAYS FROM ABOVE DATE

BILL AND DEMAND TOTAL $

SURCHARGE OR DISCOUNT $

CONNECTING CHARGE DETAIL $

NET TOTAL $33,732.68

PENALTY TOTAL $

ADD TAX

ADD TAX $

ARREARS $89,944.67

PENALTY AMOUNT DUE $

NET AMOUNT DUE $123,677.35

(See contract for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY ____________________

GVEA Electric Rate Schedules

These rates have been in effect since October 1982.

			Effective Rates (Includes fuel adjustment reduction.)
Residential	Customer Charge	$10.00	
	Energy Charge		
	First 500 kwh	$ .1125/kwh	$ .09208/kwh
	Over 500 kwh	.095/kwh	$ .07458/kwh
GS-1 (General Service-1)	Customer Charge	$20.00	
	Energy Charge		
	First 500 kwh	$ .150/kwh	$ .12958/kwh
	Next 4,500 kwh	.111/kwh	$ .09058/kwh
	Over 5,000 kwh	.095/kwh	$ .07458/kwh
GS-2 (General Service-2)	Customer Charge	$40.00	
	Demand Charge		
	All kw	$ 6.25/kw	
	Energy Charge		
	First 500 kwh	$ .1136/kwh	$ .09318/kwh
	Next 4,500 kwh	.099/kwh	$ .07858/kwh
	Next 10,000 kwh	.0934/kwh	$ .07298/kwh
	Over 15,000 kwh	.0758/kwh	$ .05538/kwh

How to Calculate Your Monthly Bill

This example shows how the total due was calculated for a sample residential bill for 874 kilowatt-hours.

Monthly customer charge	$10.00
First 500 kwh x $0.1125	56.25
Remaining 374 kwh x $0.095	35.53
	$101.78
Less fuel adjustment	
874 kwh x $.02042*	($17.85)
Regulatory Cost Charge	
874 kwh x $.000412**	.36
TOTAL DUE	$84.29

*CPA effective 12/6/94 (calculated quarterly)
**RCC effective 11/1/94

Golden Valley Electric Association

"Owned By Those We Serve."

Rev. 12/7/94

E M C ENGINEERS, INC.
2750 S. Wadsworth Blvd. Suite C-200 Denver, CO 80227 (303) 988-2951
9755 Dogwood Rd. Suite 220 Roswell, GA 30075 (404) 642-1864

JOB FT. WAINWRIGHT TURBINE STUDY
SHEET NO. 1 OF 1
CALCULATED BY BR DATE 11/21/94
CHECKED BY DATE
SCALE

ESTIMATED ENERGY COST FOR FT. WAINWRIGHT

1. FROM FIELD OBSERVATIONS AT EXISTING TG-5, STRAIGHT CONDENSING,

POWER OUTPUT = 3200 KW
STEAM FLOW (AVG) = 40,000 LB/HR

THEN ACTUAL STEAM RATE = $\frac{40{,}000 \text{ LB/HR}}{3200 \text{ KW}} = 12.53 \frac{\text{LB}}{\text{HR KW}}$

2. ENTHALPY OF STEAM AT 400 PSIG AND 650°F = H = 1336 BTU/LB

ENERGY REQUIRED FOR PRODUCING STEAM RATE =

$$1336 \text{ BTU/LB} \left(12.5 \frac{\text{LB}}{\text{HR KW}}\right) = 16{,}700 \frac{\text{BTU}}{\text{HR KW}}$$

3. HEATING VALUE OF COAL = 7800 BTU/LB (FROM PLANT PERSONNEL)
ASSUMING 80% BOILER EFFICIENCY, REQUIRED COAL =

$$\frac{16{,}700 \frac{\text{BTU}}{\text{HR KW}}}{(0.8)(7800 \text{ BTU/LB})} = 2.68 \frac{\text{LB}}{\text{KWH}}$$

4. COST OF COAL = \$45/TON (FROM PLANT PERSONNEL)

5. COST PER KWH = $2.68 \frac{\text{LB}}{\text{KWH}} \left(\frac{\$45}{2000 \text{ LB}}\right) = \$0.06/\text{KWH}$

AGREES WITH GOVERNMENT PROVIDED RATES

ENERGY CONSERVATION PROJECT TYPES
(Recommended Economic Analysis Life)

Category	Title	Description
1.	EMCS or HVAC Controls (10 years)	Projects which centrally control energy systems with the ability to automatically adjust temperature, shed electrical loads, control motor speeds or adjust lighting intensities.
2.	Steam and Condensate Systems (15 years)	Projects to install condensate lines, cross connect lines, distribution system loops, repair or install insulation and steam flow meters and controls.
3.	Boiler Plant Modifications (20 years)	Projects to upgrade or replace central boilers or ancillary equipment to improve overall efficiency. This includes fuel switching of dual fuel conversions.
4.	Heating, Ventilating, Air-Conditioning (HVAC) (20 years)	Projects to install more energy efficient heating, cooling, ventilation or hot water heating equipment. This includes the HVAC distribution systems (ducts, pipes, etc).
5.	Weatherization (20 years)	Projects improving the thermal envelope of a building. This includes building insulation (wall, roof, foundation), insulated doors, windows, vestibules, earth berming, shading, etc).
6.	Lighting Systems (15 years)	Projects to install replacement lighting systems and controls. This would include daylighting, new fixtures, lamps, ballasts, photocells, motion sensors, IR sensors, light wells, highly reflective painting, etc.
7.	Energy Recovery Systems (20 years)	Projects to install heat exchangers, regenerators, heat reclaim units or recapture energy lost to the environment.
8.	Electrical Energy Systems (20 years)	Projects that will increase the energy efficiency of an electrical device or system or reduce cost by reducing peak demand.
9.	Renewable Energy Systems (20 years)	Any project utilizing renewable energy. This includes active solar heating, cooling, hot water, industrial process heat, photovoltaic, wind, biomass, geothermal, and passive solar applications.
10.	Facility Energy Improvements (20 years)	Multiple category projects or those that do not fall into any other category.

Appendix B

Table Ba-4. FEMP UPV* Discount Factors adjusted for fuel price escalation, by end-use sector and fuel type.[a] Discount Rate = 4.1 percent (DOE)

Census Region 4 (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming)

	RESIDENTIAL				COMMERCIAL					INDUSTRIAL					TRANSPORT	
N	ELEC	DIST	LPG	NTGAS	ELEC	DIST	RESID	NTGAS	COAL	ELEC	DIST	RESID	NTGAS	COAL	GASLN	N
1	0.96	1.00	0.98	0.95	0.96	1.02	0.99	0.95	0.97	0.95	1.02	0.99	0.95	0.98	1.01	1
2	1.88	2.00	1.94	1.85	1.88	2.05	1.97	1.85	1.89	1.87	2.04	1.97	1.85	1.91	2.01	2
3	2.77	2.98	2.89	2.72	2.77	3.08	2.93	2.72	2.76	2.76	3.05	2.95	2.73	2.80	3.00	3
4	3.64	3.94	3.81	3.56	3.64	4.08	3.88	3.56	3.61	3.62	4.04	3.91	3.58	3.66	3.96	4
5	4.47	4.86	4.70	4.37	4.48	5.06	4.82	4.38	4.43	4.45	5.00	4.86	4.43	4.48	4.89	5
6	5.28	5.77	5.57	5.18	5.30	6.02	5.75	5.20	5.22	5.26	5.95	5.80	5.29	5.29	5.78	6
7	6.08	6.65	6.40	5.98	6.11	6.96	6.65	6.02	5.98	6.06	6.88	6.72	6.19	6.06	6.65	7
8	6.85	7.51	7.22	6.79	6.91	7.88	7.54	6.85	6.71	6.84	7.78	7.63	7.11	6.81	7.49	8
9	7.61	8.35	8.03	7.59	7.68	8.79	8.42	7.69	7.42	7.59	8.67	8.52	8.06	7.53	8.30	9
10	8.33	9.16	8.82	8.38	8.42	9.67	9.27	8.51	8.10	8.32	9.53	9.39	9.01	8.22	9.08	10
11	9.04	9.95	9.59	9.15	9.15	10.52	10.11	9.32	8.76	9.03	10.37	10.24	9.96	8.89	9.83	11
12	9.73	10.72	10.35	9.91	9.86	11.36	10.92	10.11	9.39	9.72	11.19	11.08	10.91	9.53	10.55	12
13	10.40	11.46	11.08	10.64	10.55	12.18	11.73	10.88	10.01	10.39	11.98	11.90	11.82	10.15	11.25	13
14	11.05	12.19	11.79	11.33	11.23	12.98	12.52	11.60	10.60	11.04	12.76	12.72	12.69	10.77	11.92	14
15	11.67	12.90	12.49	11.99	11.88	13.76	13.29	12.30	11.17	11.67	13.53	13.51	13.53	11.36	12.57	15
16	12.28	13.59	13.16	12.63	12.51	14.52	14.05	12.97	11.73	12.27	14.26	14.29	14.34	11.93	13.20	16
17	12.86	14.25	13.81	13.25	13.11	15.26	14.79	13.62	12.26	12.85	14.98	15.05	15.12	12.49	13.80	17
18	13.42	14.89	14.44	13.85	13.70	15.98	15.51	14.25	12.78	13.41	15.68	15.79	15.88	13.02	14.39	18
19	13.97	15.52	15.05	14.42	14.27	16.67	16.21	14.85	13.28	13.95	16.35	16.52	16.61	13.54	14.95	19
20	14.49	16.12	15.64	14.98	14.82	17.35	16.90	15.44	13.75	14.47	17.01	17.23	17.32	14.04	15.50	20
21	15.00	16.70	16.20	15.51	15.35	18.01	17.57	16.00	14.22	14.97	17.65	17.92	18.01	14.52	16.02	21
22	15.49	17.27	16.75	16.03	15.86	18.65	18.22	16.55	14.66	15.45	18.26	18.59	18.68	14.99	16.53	22
23	15.97	17.82	17.28	16.53	16.35	19.26	18.86	17.08	15.09	15.92	18.86	19.25	19.32	15.44	17.03	23
24	16.43	18.35	17.79	17.01	16.83	19.86	19.48	17.59	15.50	16.37	19.44	19.89	19.94	15.88	17.50	24
25	16.87	18.86	18.28	17.48	17.29	20.44	20.08	18.08	15.90	16.80	20.00	20.52	20.54	16.30	17.96	25
26/a	17.30	19.35	18.75	17.93	17.74	21.00	20.66	18.56	16.29	17.21	20.55	21.12	21.13	16.70	18.40	26
27/a	17.71	19.83	19.21	18.36	18.17	21.55	21.23	19.02	16.66	17.61	21.07	21.71	21.69	17.09	18.83	27
28/a	18.12	20.29	19.65	18.78	18.59	22.07	21.78	19.46	17.01	18.00	21.58	22.28	22.24	17.47	19.24	28
29/a	18.50	20.74	20.07	19.19	18.99	22.58	22.31	19.89	17.36	18.37	22.07	22.84	22.77	17.84	19.64	29
30/a	18.88	21.17	20.48	19.58	19.38	23.07	22.83	20.31	17.69	18.72	22.55	23.37	23.28	18.19	20.02	30

[a] UPV* factors are reported for years 26-30 to accommodate a planning/construction period of up to 5 years. (See p. 6 for instructions on use.)

Estimated Energy Savings

1995 - 1997 Study

Load Factor - The load factor is defined as the ratio of the total kilowatt-hours measured to the peak kilowatts measured times the hours in the measurement period. For the purpose of this study the daily load factor is calculated for the day on which the peak load for the base occurred during each month for the months July 1994 through July 1995.

The load factor is calculated by summing the hourly kilowatt readings on the day of each month when the monthly peak occurred and dividing the sum by the daily peak kilowatt measurement times twenty-four hours. All values used are taken from the electric power plant operating log under the column heading "TOTAL GEN". This column is read off the plant totalizer meter by operating personnel every hour and provides the most accurate data for calculation of the load factor. The attached sheets show a plot of the daily load for each day used in the study.

Date	Daily Load Factor	Date	Daily Load Factor
5-Jul-95	77.4%	7-Dec-94	82.2%
23-Jun-95	77.1%	30-Nov-94	81.3%
16-May-95	77.7%	27-Oct-94	81.5%
5-Apr-95	78.6%	14-Sep-94	77.9%
14-Mar-95	81.8%	29-Aug-94	79.3%
23-Feb-95	82.8%	21-Jul-94	75.8%
27-Jan-95	80.8%		

The average daily load factor as defined for this study is the average of the sample daily load factors.

Average Load Factor = 79.6%

The average load factor is applied to the calculated line losses to approximate the daily average:

Study Title	Total Peak Line Losses	Average Line Losses
Case 1 Load Flow Study - Existing 2400 volt ungrounded delta system	76.1 KW	60.5 KW
Case 2 Load Flow Study - New 4160 volt grounded wye system	44.2 KW	35.2 KW

(Refer to appendix B for line loss calculations)

The KW savings is computed by subtracting the average losses of Case 2 from the average losses of Case 1: KW Savings: 25.4 KW

The annual energy savings is the KW savings times the hours per year

KWH savings per year: 222329.7 KWH

E M C Engineers, Inc.
EMC#1406-003
Ft. Greely, Alaska

ECON1997.XLS
Prepared by: D Morris
1/10/96
Checked by: F. Jones

1. COMPONENT ARMY	MILITARY CONSTRUCTION PROJECT DATA	2. DATE Dec-95
3. INSTALLATION AND LOCATION	Fort Greely, Alaska	
4. PROJECT TITLE	Limited Energy Study, Power Distribution 1995 to 1997 Study	5. PROJECT NUMBER DACA01-94-D-0033

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Fort Greely, Alaska — REGION: 4 — PROJECT NO: 1406.003
PROJECT TITLE: ECIP: Limited Energy Study, Power Distribution — FISCAL YEAR: 1995
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 01/10/96 — ECONOMIC LIFE: 20 — PREPARED BY: D Morris

1. INVESTMENT

A.	CONSTRUCTION COST	= =	$994,468	
B.	SIOH COST	(5.5% of 1A) =	$54,696	
C.	DESIGN COST	(6.0% of 1A) =	$59,668	
D.	TOTAL COST	(1A +1B +1C) =	$1,108,832	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =			
F.	PUBLIC UTILITY COMPANY REBATE =			
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$1,108,832

2. ENERGY SAVINGS (+) OR COST (-):
DATE OF NISTIR 85-3273-10 USED FOR DISCOUNT FACTORS: OCT '95

	ENERGY SOURCE	FUEL COST $/kWh (1)	SAVINGS kWh (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECTRICITY	$0.0832	222,330	$18,498	14.47	$267,664	
B.	DIST						
C.	NAT GAS						
D.	REFUS						
E.	COAL						
F.	OTHER						
G.	OTHER						
H.	TOTAL		222,330	$18,498		-------->	$267,664

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)
1 DISCOUNT FACTOR (From Table A) =
2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) =

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE B)	DISCOUNTED SAVINGS/COST (4)
a.				
b.				
c.				
d. TOTAL				

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A2 + 3Bd4) =

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2H3+3A+(3Bd1/Economic Life))	$18,498
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	59.94
6.	TOTAL NET DISCOUNTED SAVINGS	(2H5 + 3C) =	$267,664
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	0.24

Estimated Energy Savings

Post 2001 Study

Load Factor - The load factor is defined as the ratio of the total kilowatt-hours measured to the peak kilowatts measured times the hours in the measurement period. For the purpose of this study the daily load factor is calculated for the day on which the peak load for the base occurred during each month for the months July 1994 through July 1995.

The load factor is calculated by summing the hourly kilowatt readings on the day of each month when the monthly peak occurred and dividing the sum by the daily peak kilowatt measurement times twenty-four hours. All values used are taken from the electric power plant operating log under the column heading "TOTAL GEN". This column is read off the plant totalizer meter by operating personnel every hour and provides the most accurate data for calculation of the load factor. The attached sheets show a plot of the daily load for each day used in the study.

Date	Daily Load Factor	Date	Daily Load Factor
5-Jul-95	77.4%	7-Dec-94	82.2%
23-Jun-95	77.1%	30-Nov-94	81.3%
16-May-95	77.7%	27-Oct-94	81.5%
5-Apr-95	78.6%	14-Sep-94	77.9%
14-Mar-95	81.8%	29-Aug-94	79.3%
23-Feb-95	82.8%	21-Jul-94	75.8%
27-Jan-95	80.8%		

The average daily load factor as defined for this study is the average of the sample daily load factors.

Average Load Factor = 79.6%

The average load factor is applied to the calculated line losses to approximate the daily average:

Study Title	Total Peak Line Losses	Average Line Losses
Case 3 Load Flow Study - Existing 2400 volt ungrounded delta system	13.6 KW	10.8 KW
Case 4 Load Flow Study - New 4160 volt grounded wye system	11.2 KW	8.9 KW

(Refer to appendix B for line loss calculations)

The KW savings is computed by subtracting the average losses of Case 4 from the average losses of Case 3: KW Savings: 1.9 KW

The annual energy savings is the KW savings times the hours per year

KWH savings per year: 16727.0 KWH

E M C Engineers, Inc.
EMC#1406-003
Ft. Greely, Alaska

ECON2001.XLS
Prepared by: D Morris
1/10/96
Checked by: F. Jones

1. COMPONENT ARMY	MILITARY CONSTRUCTION PROJECT DATA	2. DATE Dec-95
3. INSTALLATION AND LOCATION Fort Greely, Alaska		
4. PROJECT TITLE	Limited Energy Study, Power Distribution Post 2001 Study	5. PROJECT NUMBER DACA01-94-D-0033

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Fort Greely, Alaska — REGION: 4 — PROJECT NO: 1406.003
PROJECT TITLE: ECIP: Limited Energy Study, Power Distribution — FISCAL YEAR: 1995
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 01/10/96 — ECONOMIC LIFE: 20 — PREPARED BY: D Morris

1.	INVESTMENT				
A.	CONSTRUCTION COST	= =	$714,073		
B.	SIOH COST	(5.5% of 1A) =	$39,274		
C.	DESIGN COST	(6.0% of 1A) =	$42,844		
D.	TOTAL COST	(1A +1B +1C) =	$796,191		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =				
F.	PUBLIC UTILITY COMPANY REBATE =				
G.	TOTAL INVESTMENT	(1D -1E -1F) =		------->	$796,191

2. ENERGY SAVINGS (+) OR COST (-):
DATE OF NISTIR 85-3273-10 USED FOR DISCOUNT FACTORS: OCT '95

	ENERGY SOURCE	FUEL COST $/kWh (1)	SAVINGS kWh (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	ISCOUNTED SAVINGS (5)	
A.	ELECTRICITY	$0.0832	16,727	$1,392	14.47	$20,138	
B.	DIST						
C.	NAT GAS						
D.	REFUS						
E.	COAL						
F.	OTHER						
G.	OTHER						
H.	TOTAL		16,727	$1,392		-------->	$20,138

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)
1 DISCOUNT FACTOR (From Table A) =
2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) =

B. NON-RECURRING (+/-)

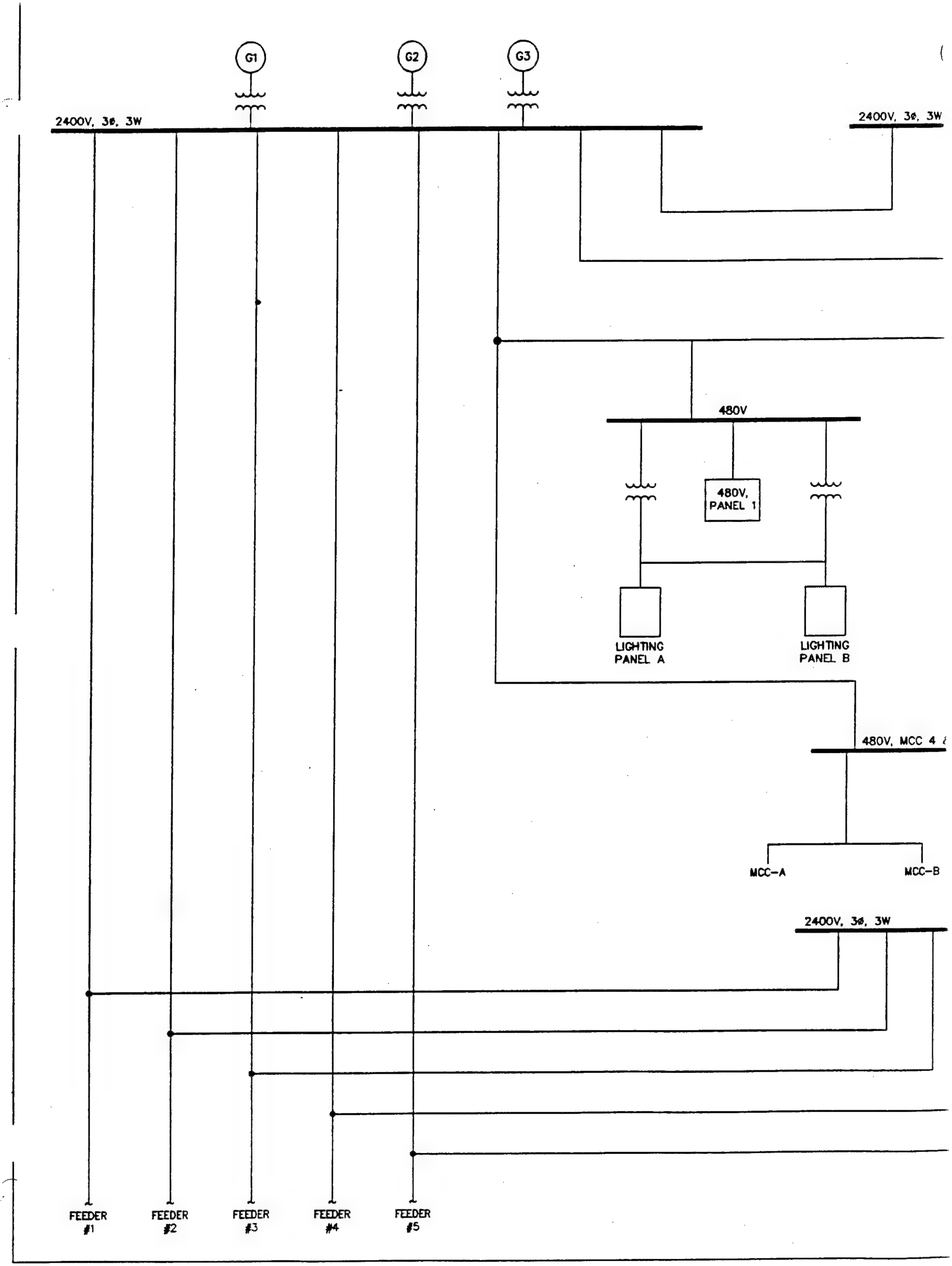
ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE B)	DISCOUNTED SAVINGS/COST (4)
a.				
b.				
c.				
d. TOTAL				

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A2 + 3Bd4) =

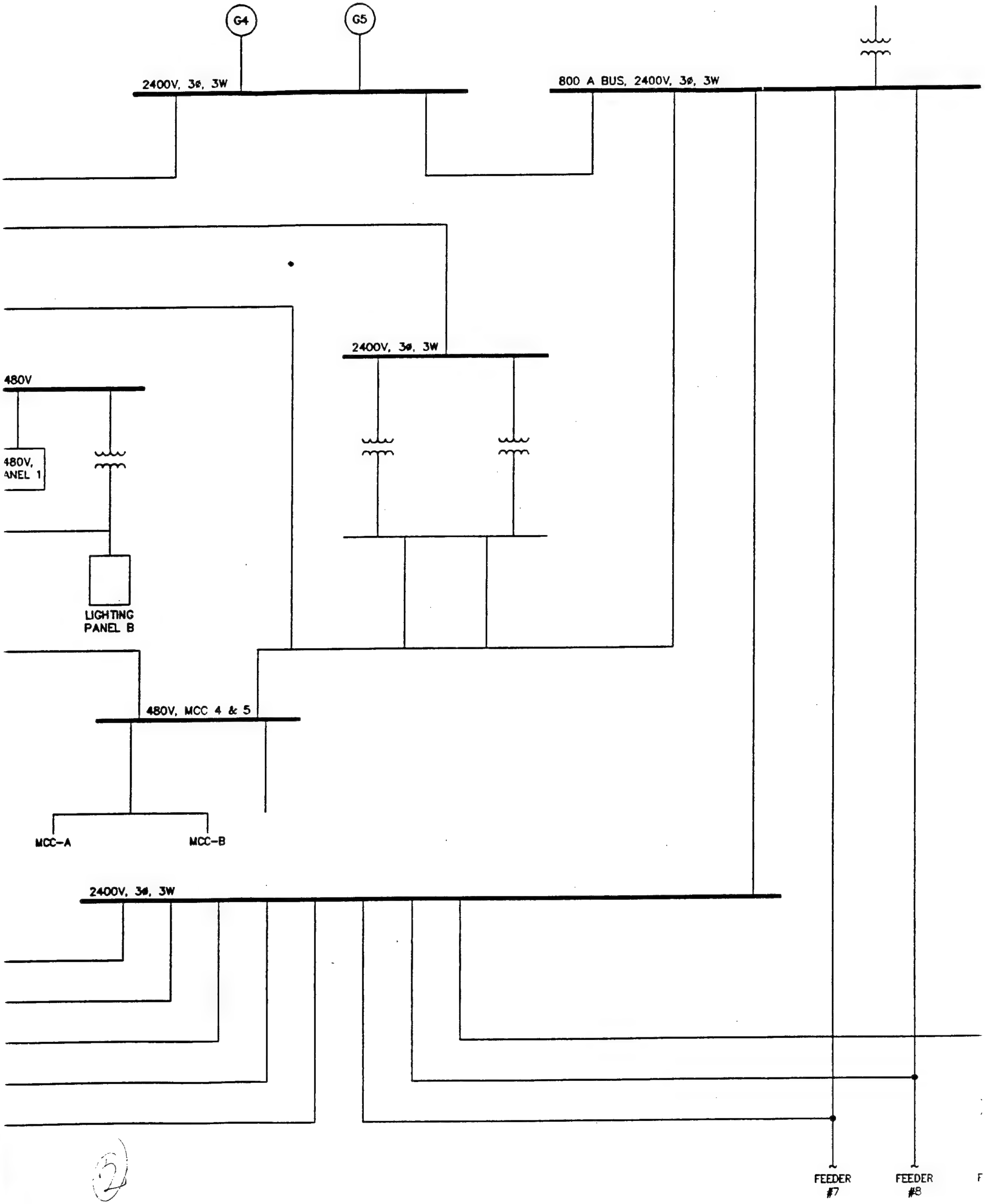
4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2H3+3A+(3Bd1/Economic Life))	$1,392
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	572.11
6.	TOTAL NET DISCOUNTED SAVINGS	(2H5 + 3C) =	$20,138
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	0.03

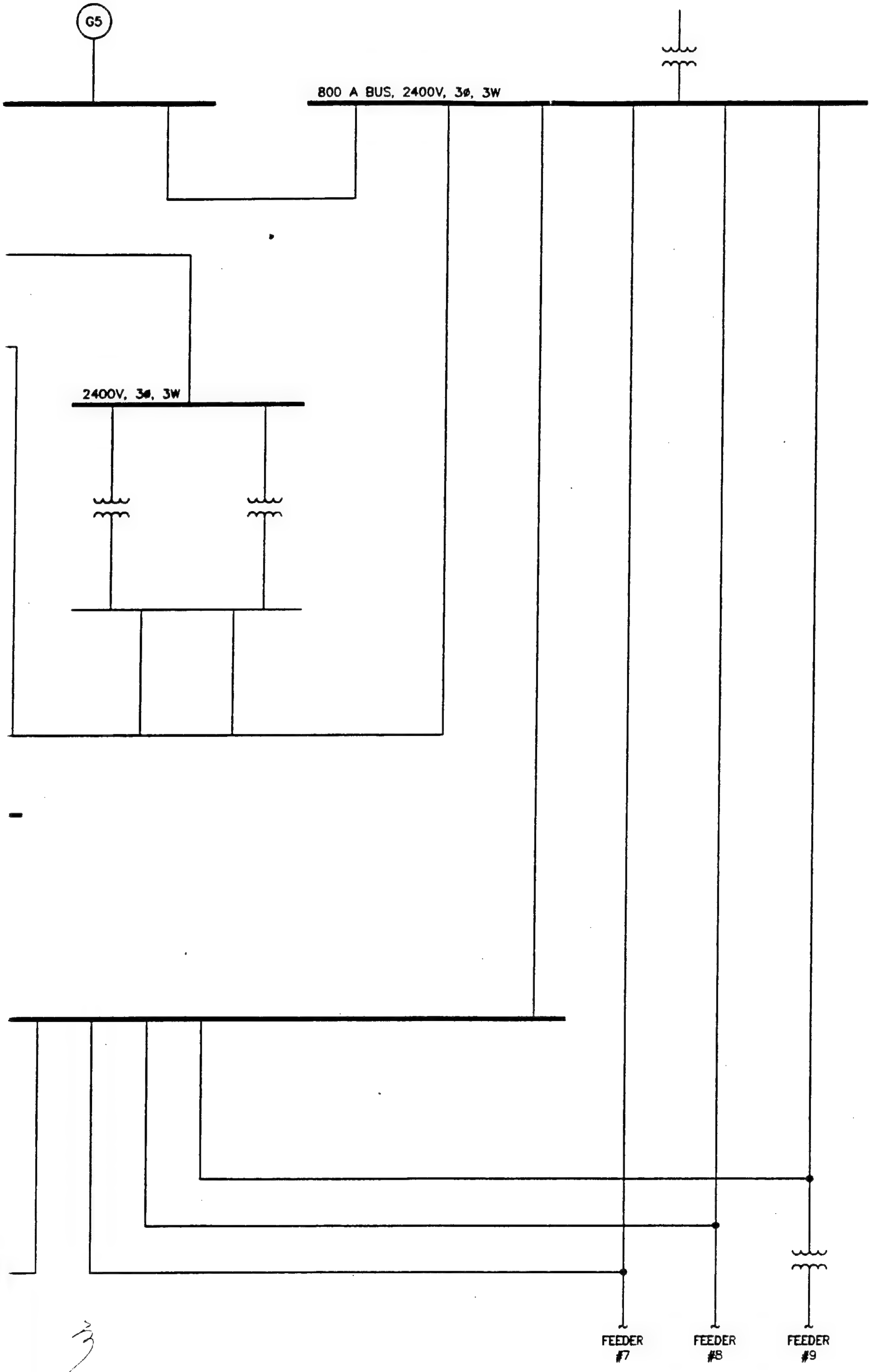
APPENDIX L

One-Line Diagrams



G1
G2
G3
2400V, 3ø, 3W
2400V, 3ø, 3W
480V
480V, PANEL 1
LIGHTING PANEL A
LIGHTING PANEL B
480V, MCC 4
MCC-A
MCC-B
2400V, 3ø, 3W
FEEDER #1
FEEDER #2
FEEDER #3
FEEDER #4
FEEDER #5


G4
G5
2400V, 3ø, 3W
800 A BUS, 2400V, 3ø, 3W
2400V, 3ø, 3W
480V
480V,
ANEL 1
LIGHTING
PANEL B
480V, MCC 4 & 5
MCC-A
MCC-B
2400V, 3ø, 3W
FEEDER
#7
FEEDER
#8
F



DACA87-94-D-0028
CONTRACT NO.

DIRECTORATE OF PUBLIC WORKS
6th INFANTRY DIVISION (LIGHT)
FORT RICHARDSON, ALASKA 99505-5500

PROJECT TITLE

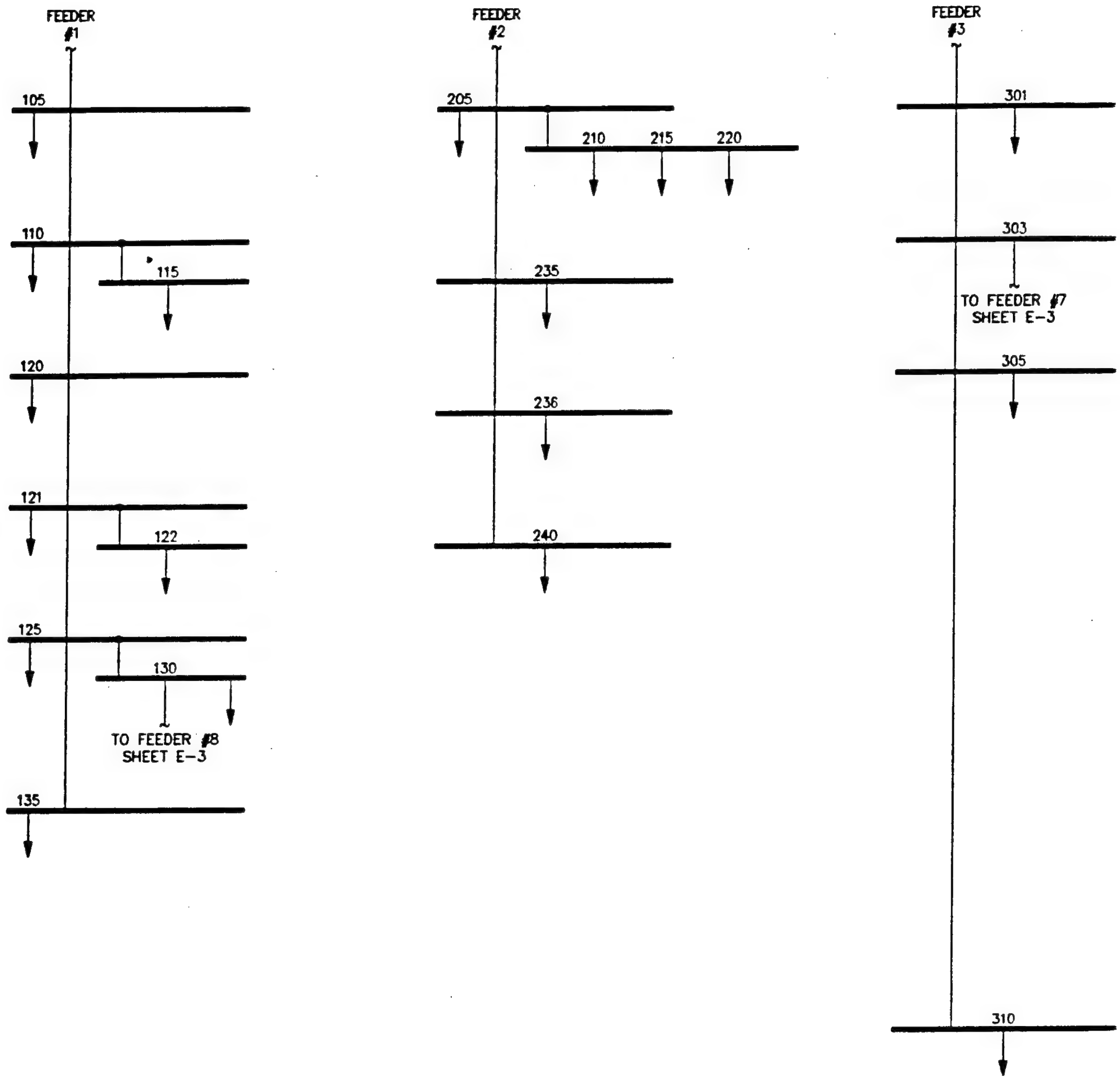
ONE–LINE DIAGRAM
1995 – 1997 STUDY

INSTALLATION FT. GREELEY, ALASKA | PROJECT NO. 1408.003 | DRAWING NO. ////

E–1

SHEET 1 OF 3

PLOT DATE: <Plot Date: 01/11/96>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105
110
115
120
121
122
125
130
TO FEEDER #8 SHEET E-3
135
FEEDER #2
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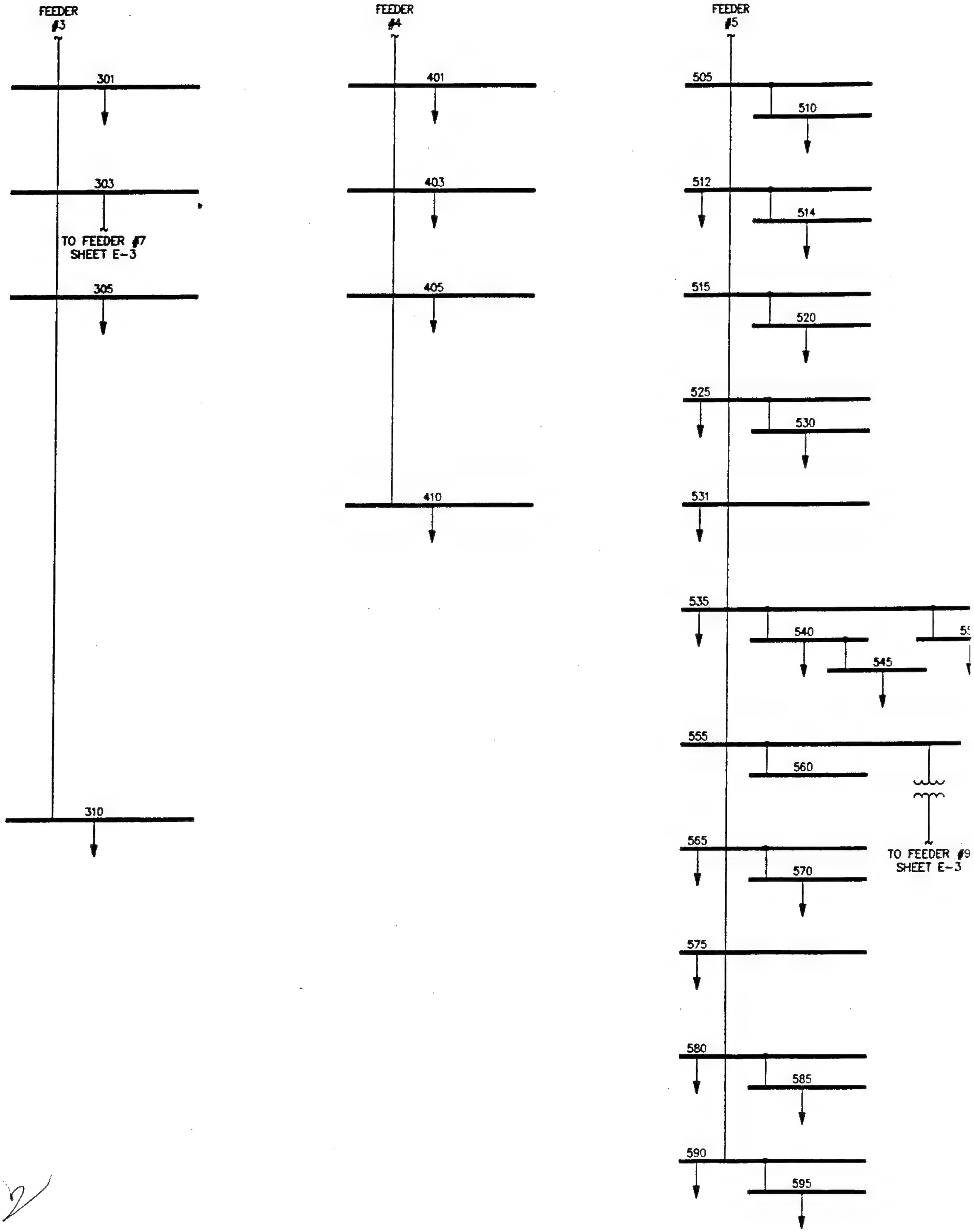
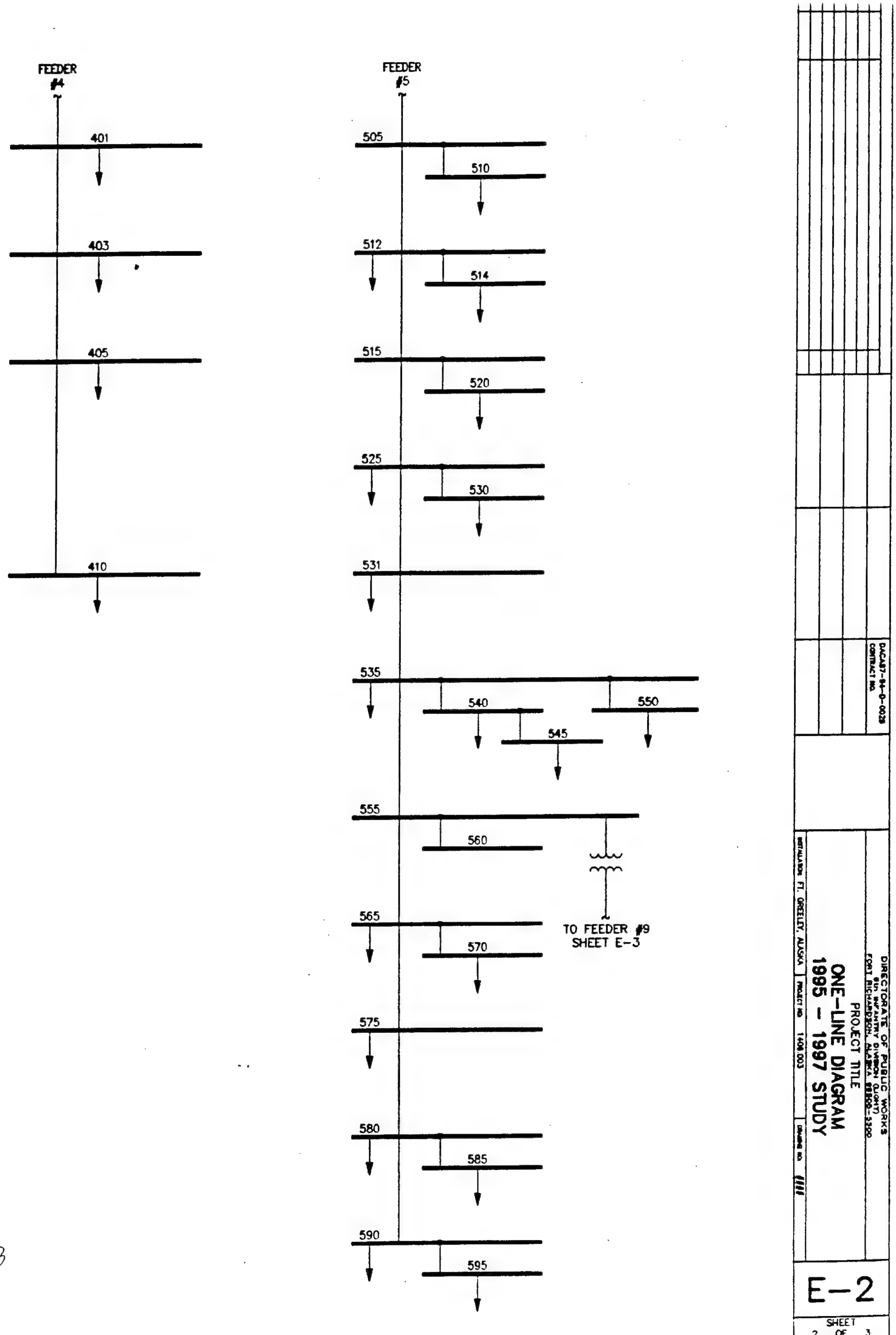
210
215
220
235
236
240
FEEDER #3
301
303
TO FEEDER #7 SHEET E-3
305
310


FEEDER #3
301
303
TO FEEDER #7
SHEET E-3
305
310
FEEDER #4
401
403
405
410
FEEDER #5
505
510
512
514
515
520
525
530
531
535
540
545
555
560
TO FEEDER #9
SHEET E-3
565
570
575
580
585
590
595



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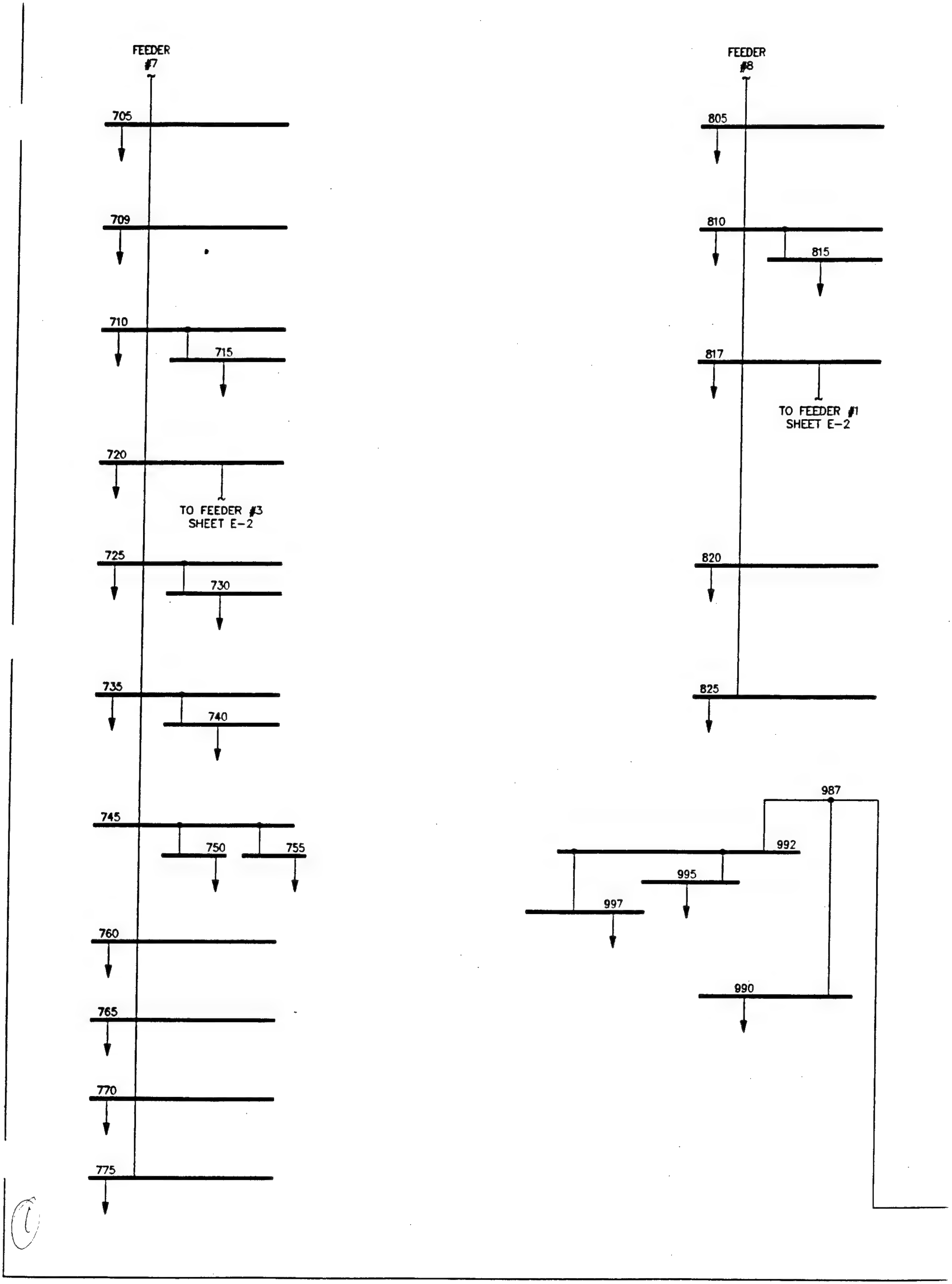
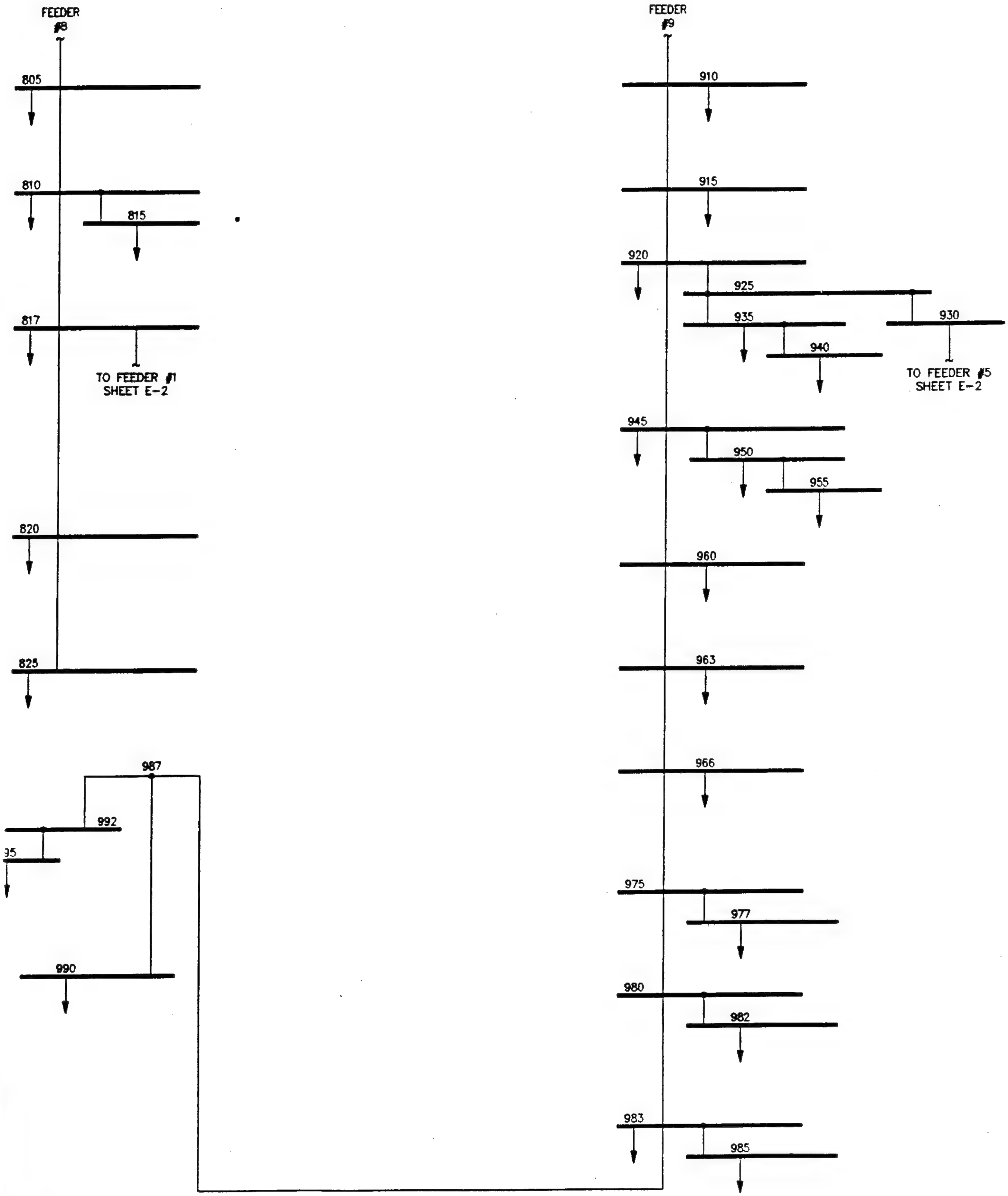
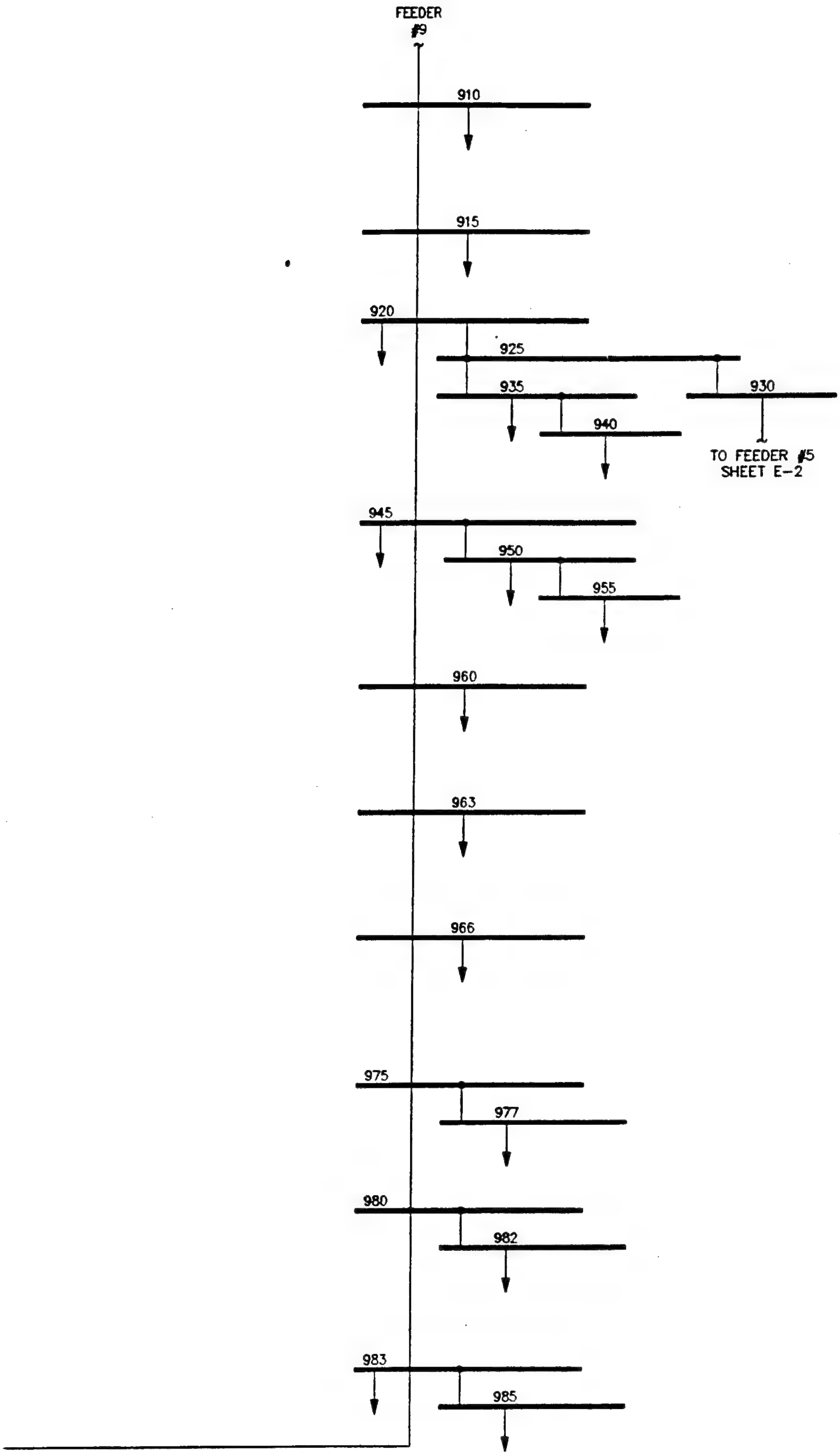


FEEDER #7
705
709
710
715
720
TO FEEDER #3 SHEET E-2
725
730
735
740
745
750
755
760
765
770
775
FEEDER #8
805
810
815
817
TO FEEDER #1 SHEET E-2
820
825
987
992
995
997
990



FEEDER #8
805
810
815
817
TO FEEDER #1 SHEET E-2
820
825
987
992
95
990
FEEDER #9
910
915
920
925
930
935
940
TO FEEDER #5 SHEET E-2
945
950
955
960
963
966
975
977
980
982
983
985



DIRECTORATE OF PUBLIC WORKS
6th INFANTRY DIVISION (LIGHT)
FORT RICHARDSON, ALASKA 99505-5500

PROJECT TITLE

ONE-LINE DIAGRAM
1995 - 1997 STUDY

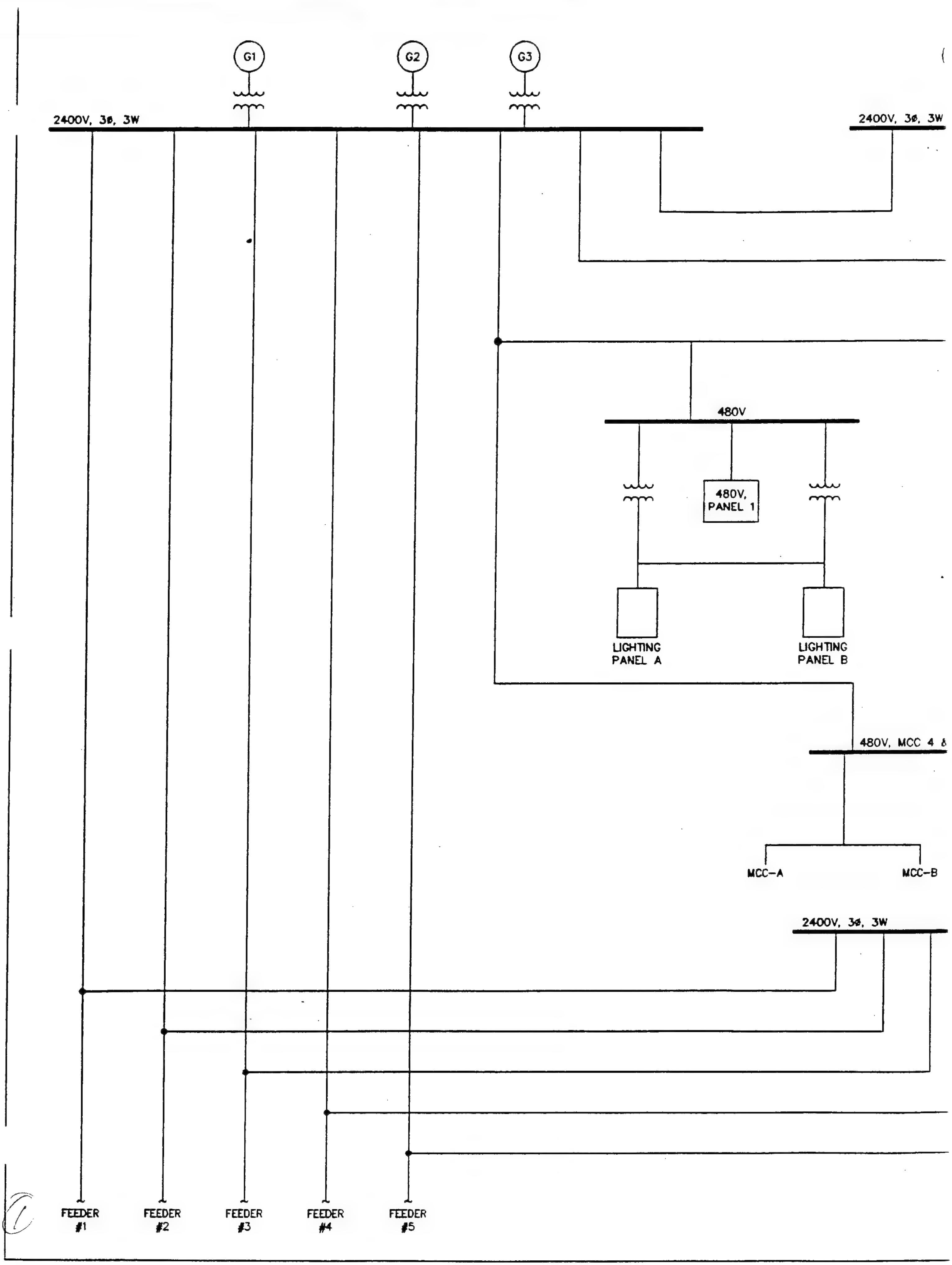
INSTALLATION FT. GREELY, ALASKA | PROJECT NO 1408.003 | DRAWING NO

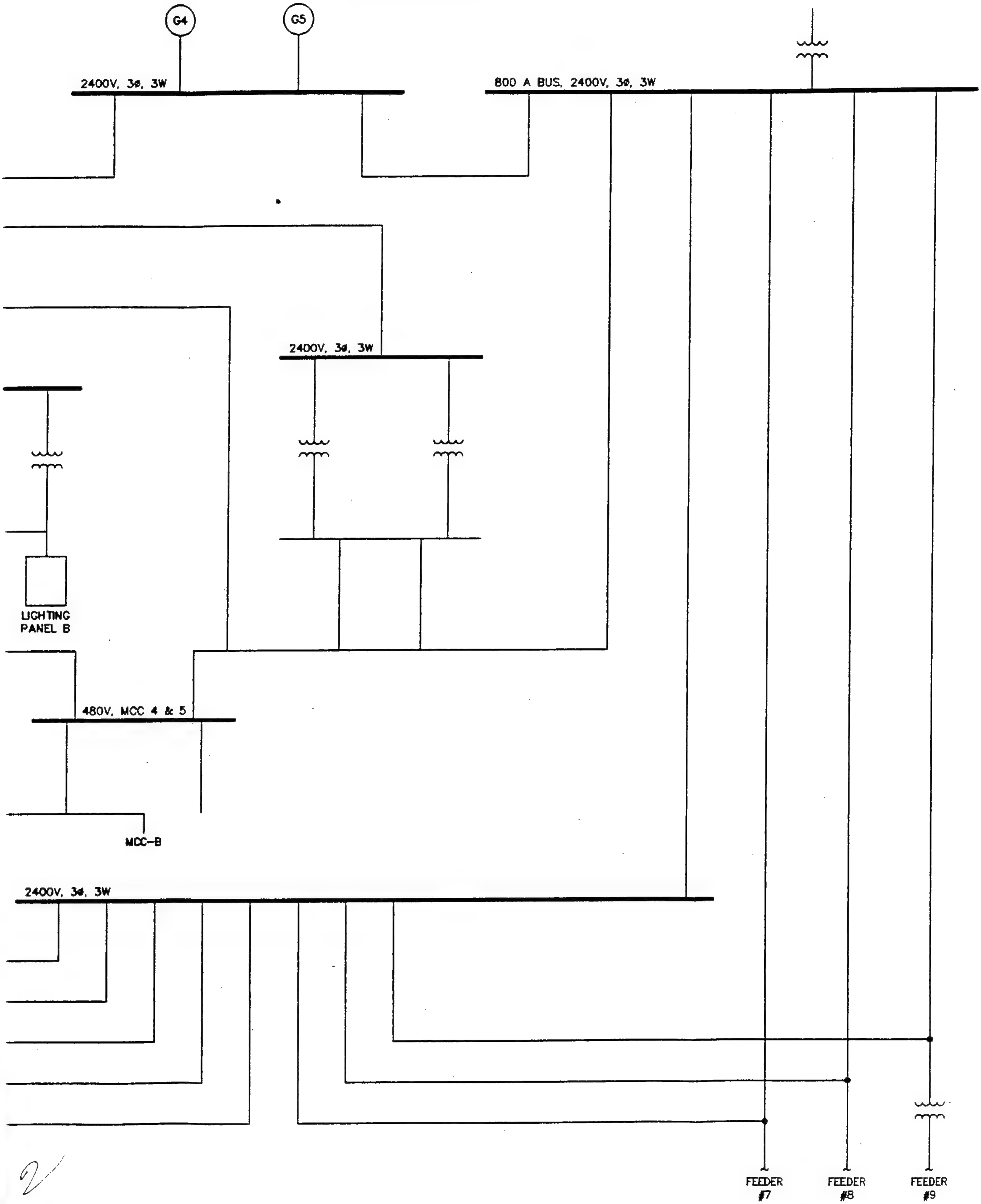
DACA85-94-D-0028
CONTRACT NO

E-3

SHEET 3 OF 3

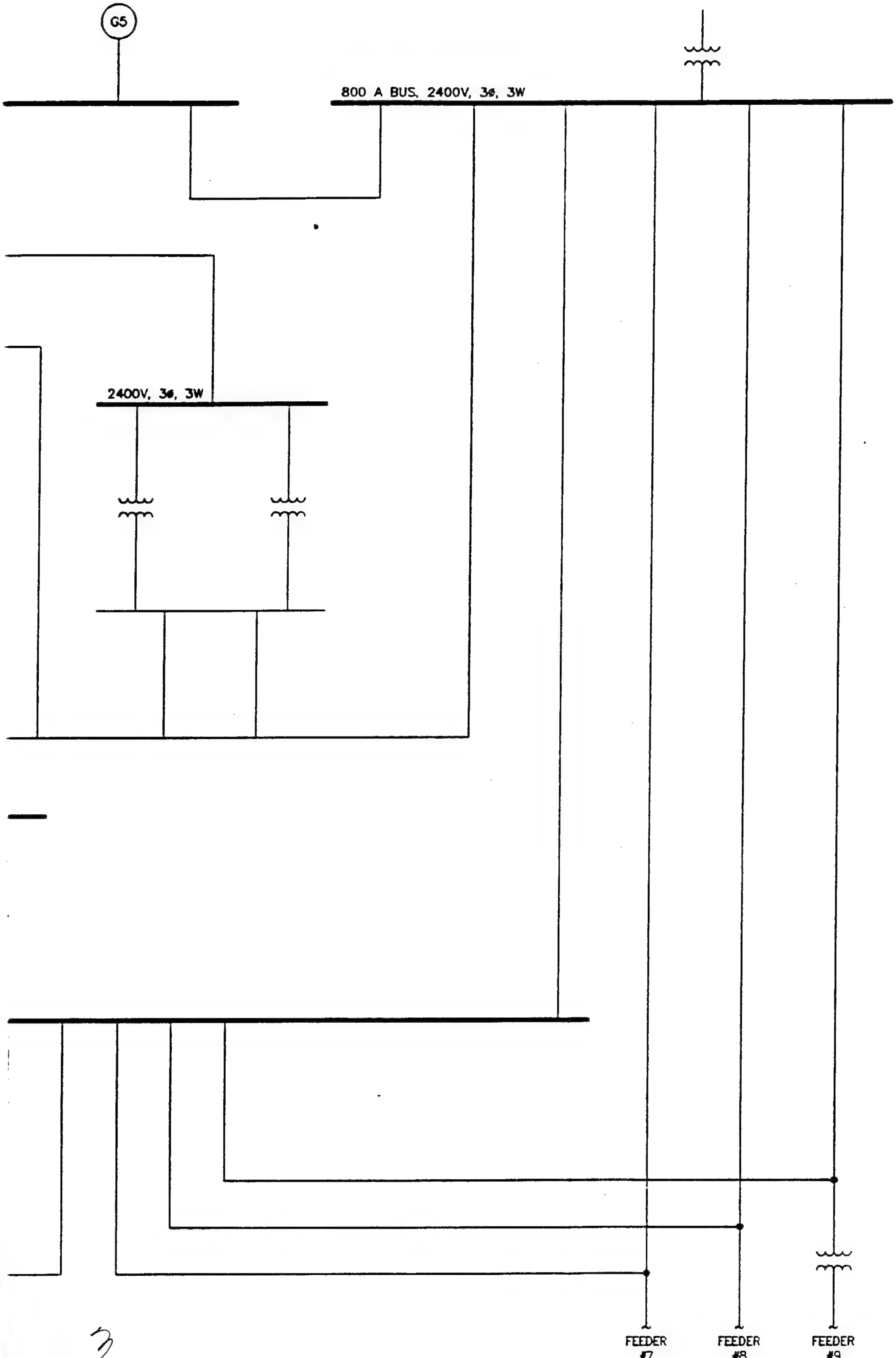
PLOT DATE: <Plot Date: 01/11/95>


G1
G2
G3
2400V, 3ø, 3W
2400V, 3ø, 3W
480V
480V, PANEL 1
LIGHTING PANEL A
LIGHTING PANEL B
480V, MCC 4 &
MCC-A
MCC-B
2400V, 3ø, 3W
FEEDER #1
FEEDER #2
FEEDER #3
FEEDER #4
FEEDER #5



G4
G5
2400V, 3ø, 3W
800 A BUS, 2400V, 3ø, 3W
2400V, 3ø, 3W
LIGHTING PANEL B
480V, MCC 4 & 5
MCC-B
2400V, 3ø, 3W
FEEDER #7
FEEDER #8
FEEDER #9

P.



3

DIRECTORATE OF PUBLIC WORKS
6th INFANTRY DIVISION (LIGHT)
FORT RICHARDSON, ALASKA 99505-6500

PROJECT TITLE

ONE-LINE DIAGRAM
POST - 2001 STUDY

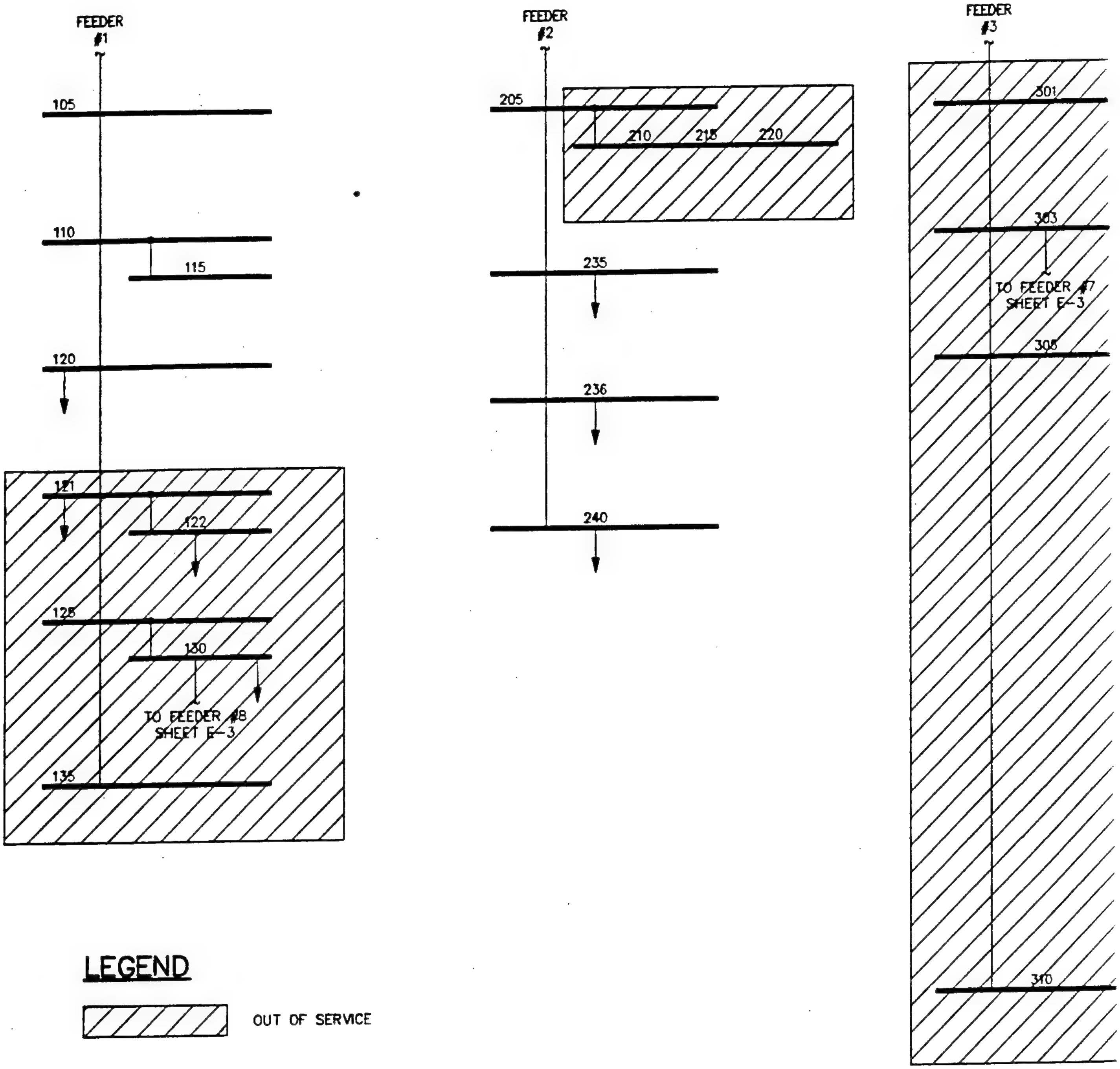
INSTALLATION FT. GREELY, ALASKA | PROJECT NO. 1408.003 | DRAWING NO. ####

CONTRACT NO. DACA87-94-D-0028

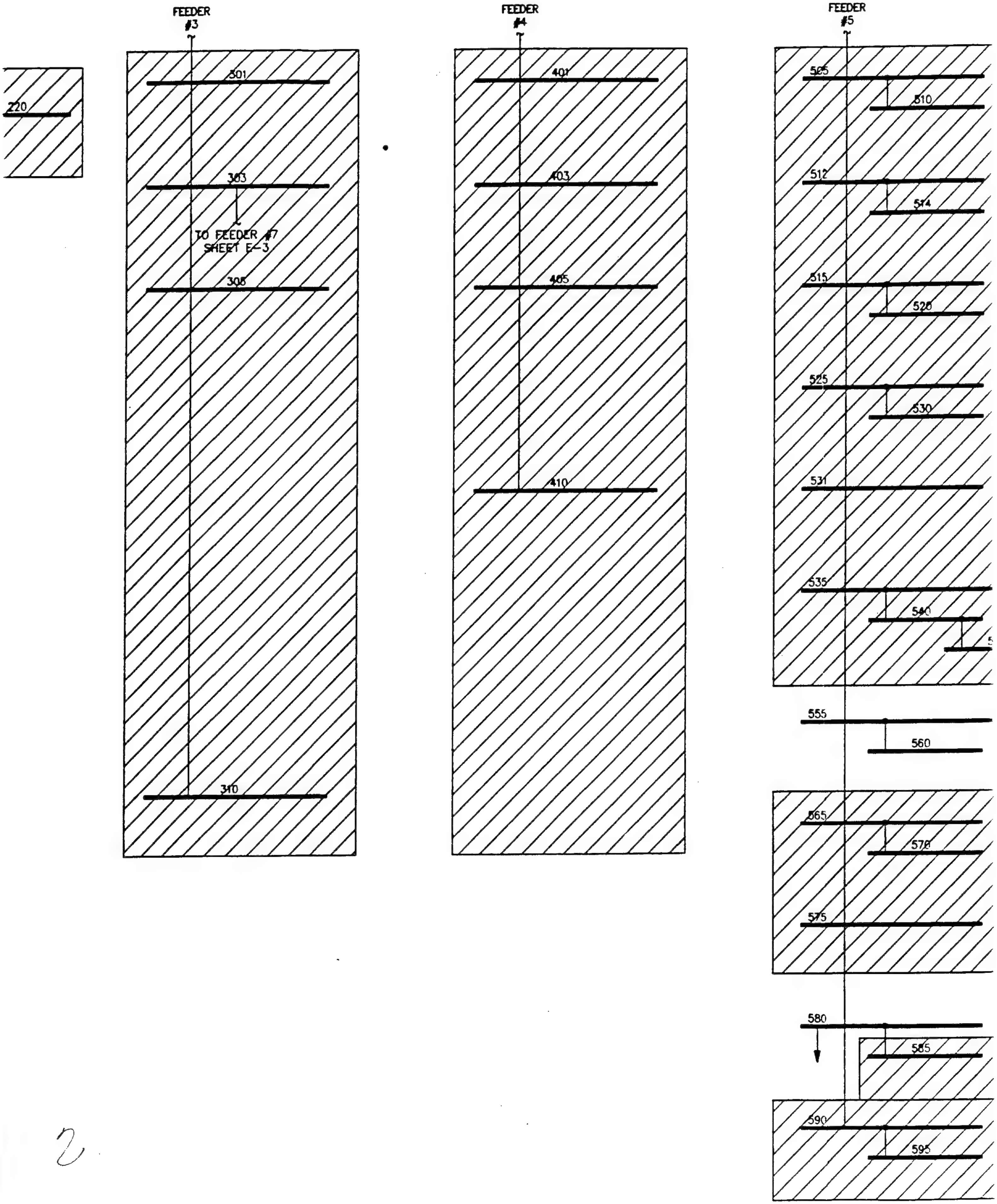
E-1

SHEET 1 OF 3

PLOT DATE: <Plot Date. 01/11/96>


FEEDER #1
105
110
115
120
121
122
125
130
TO FEEDER #8
SHEET E-3
135
FEEDER #2
205
210
215
220
235
236
240
FEEDER #3
301
303
TO FEEDER #7
SHEET E-3
305
310
LEGEND
OUT OF SERVICE

1


FEEDER #3
FEEDER #4
FEEDER #5
220
301
303
TO FEEDER #7 SHEET E-3
305
310
401
403
405
410
505
510
512
514
515
520
525
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531
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565
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585
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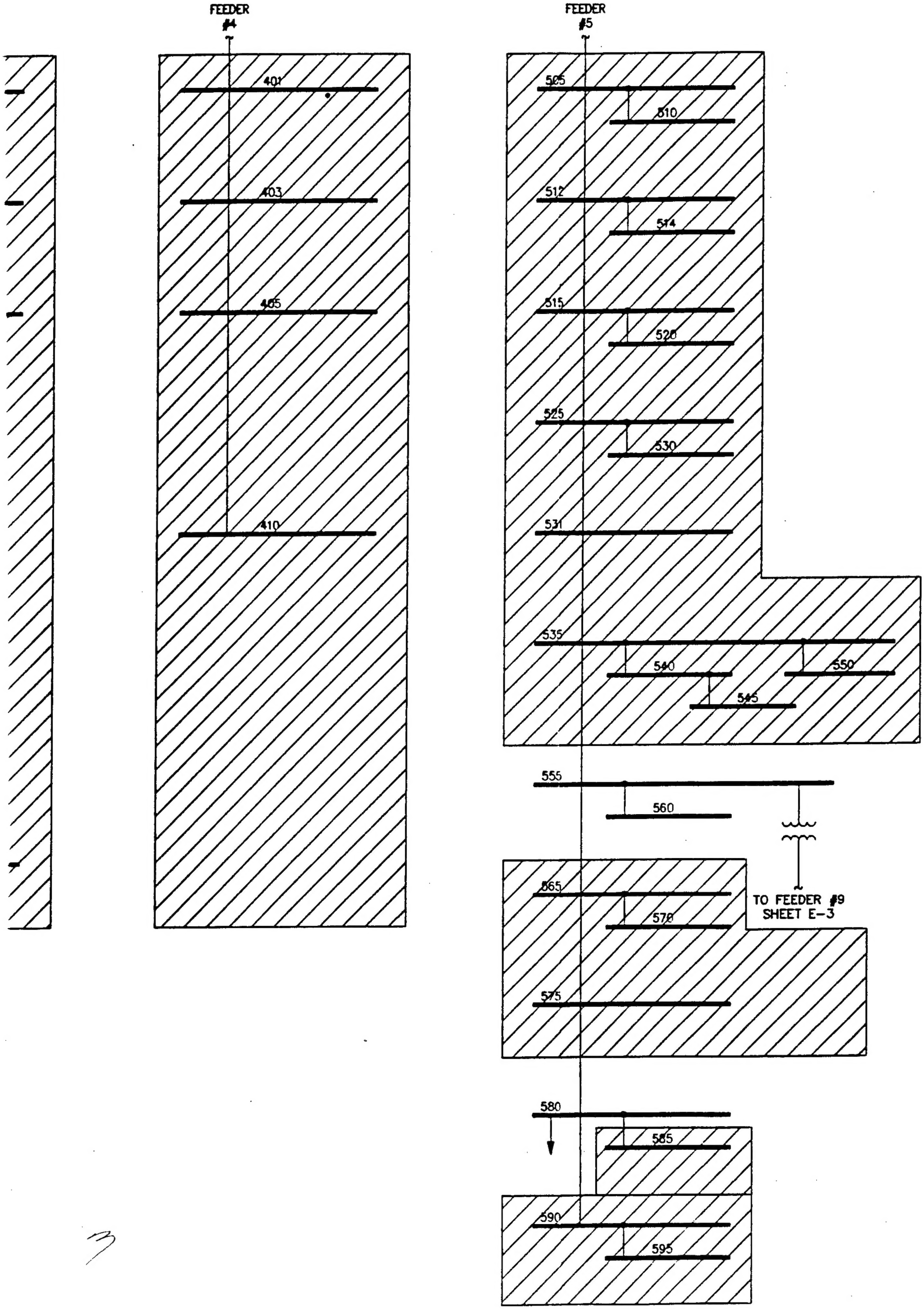
595

2



DACA87-94-D-0028
CONTRACT NO.

DIRECTORATE OF PUBLIC WORKS
6th INFANTRY DIVISION (LIGHT)
FORT RICHARDSON, ALASKA 99505-5100

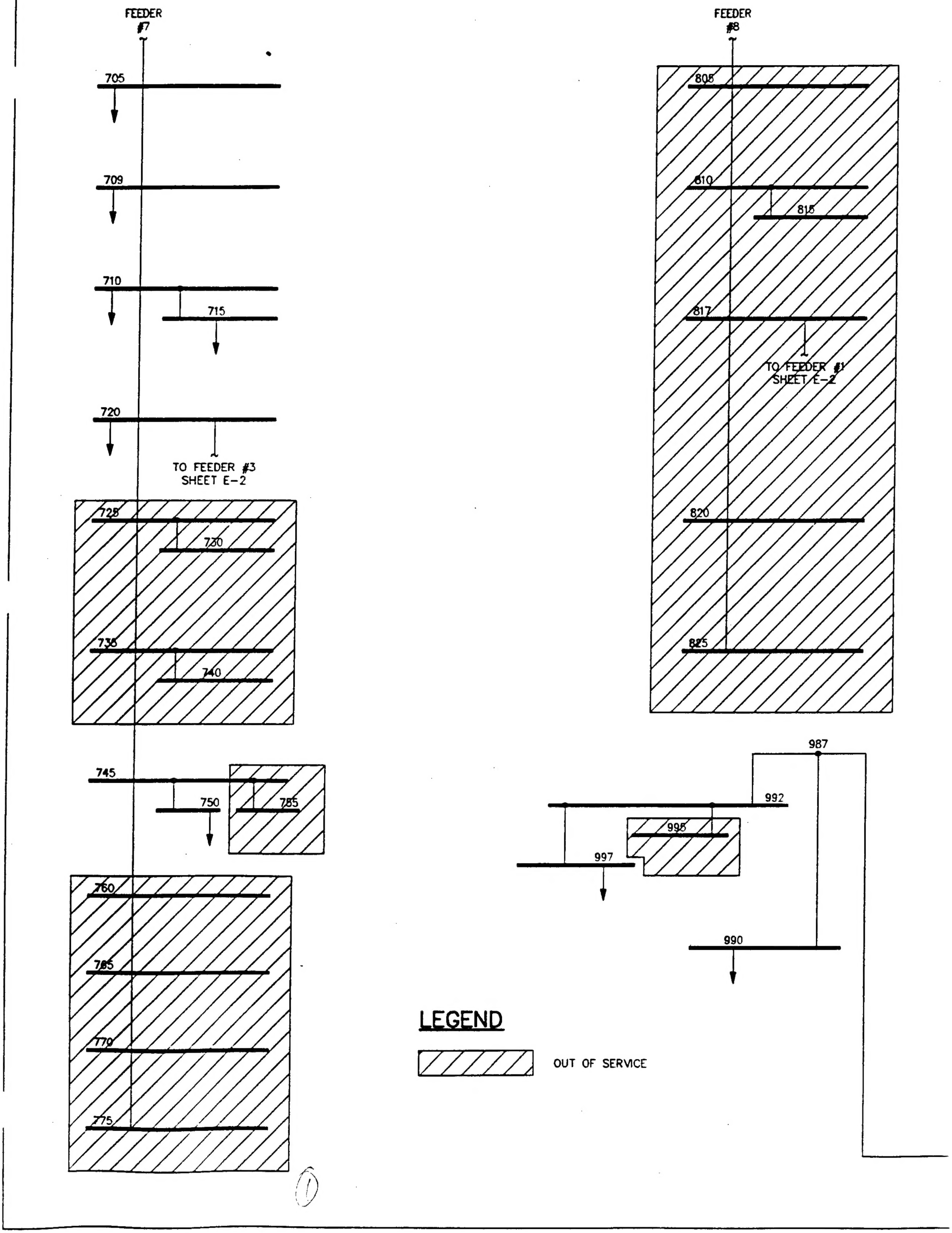
PROJECT TITLE
ONE-LINE DIAGRAM
POST - 2001 STUDY

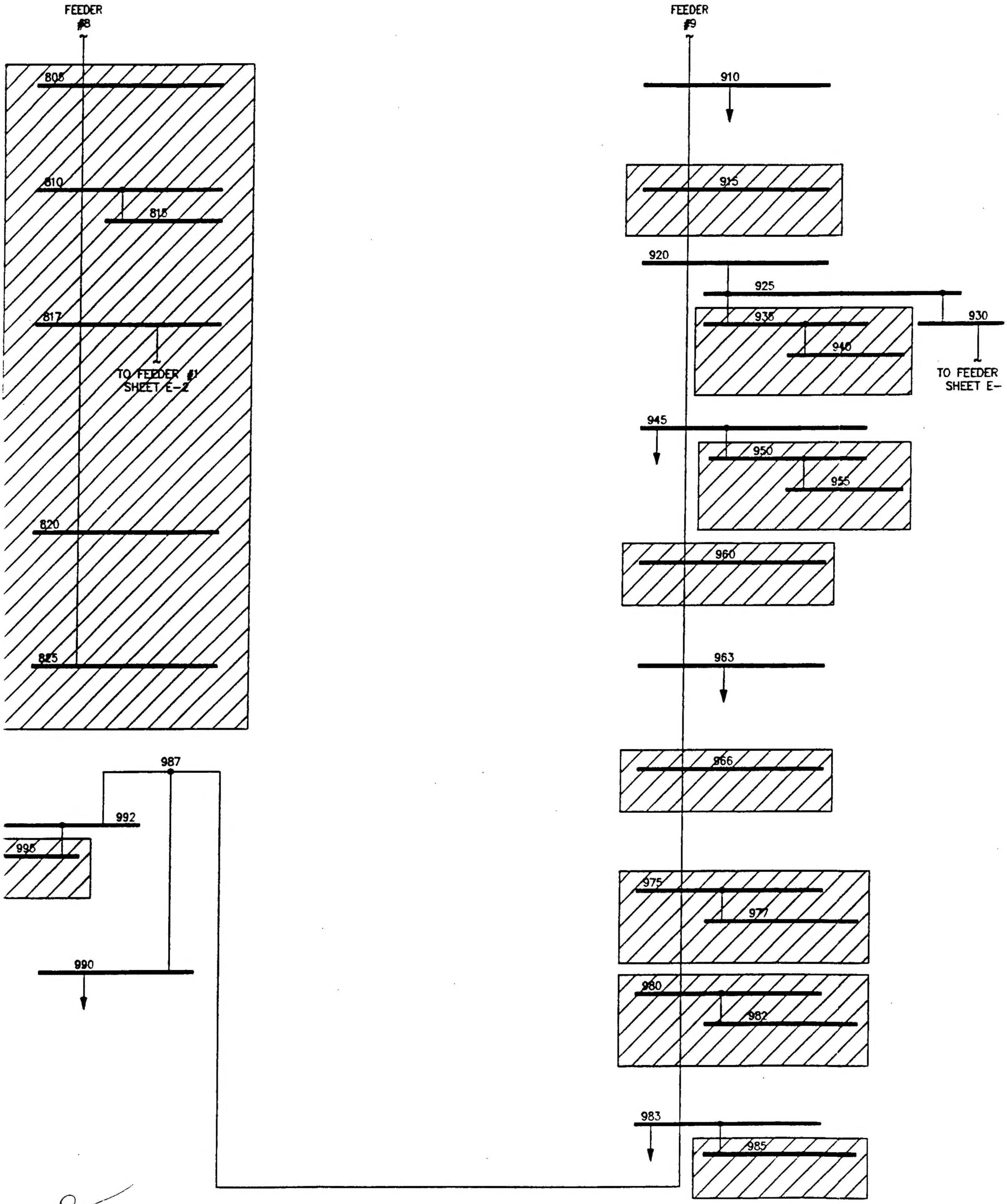
INSTALLATION FT. GREELY, ALASKA | PROJECT NO 1408.003 | DRAWING NO

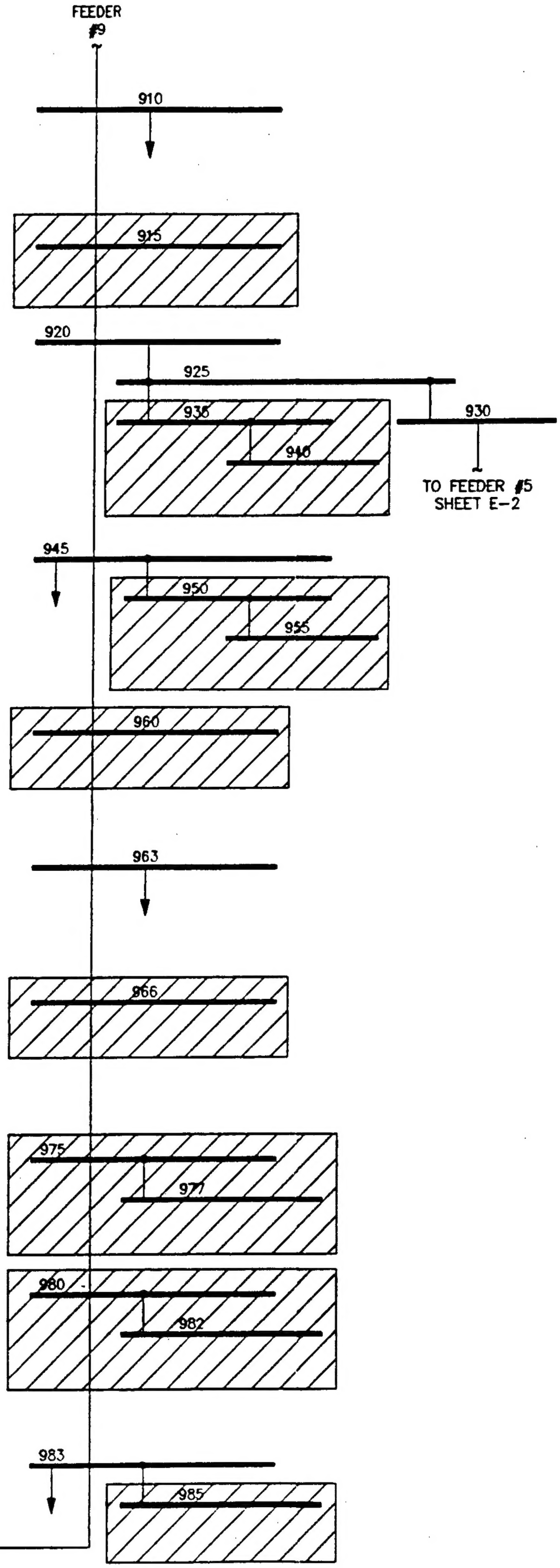
E-2

SHEET 2 OF 3

PLOT DATE: <Plot Date. 01/11/96>


FEEDER #7
705
709
710
715
720
TO FEEDER #3 SHEET E-2
725
730
735
740
745
750
755
760
765
770
775
FEEDER #8
805
810
815
817
TO FEEDER #1 SHEET E-2
820
825
987
992
995
997
990
LEGEND
OUT OF SERVICE


FEEDER
#8
FEEDER
#9
805
810
815
817
TO FEEDER #1
SHEET E-2
820
825
910
915
920
925
930
935
940
TO FEEDER
SHEET E-
945
950
955
960
963
966
975
977
980
982
983
985
987
990
992
995



B

DIRECTORATE OF PUBLIC WORKS
6th INFANTRY DIVISION (LIGHT)
FORT RICHARDSON, ALASKA 99505-5500

PROJECT TITLE

ONE-LINE DIAGRAM
POST – 2001 STUDY

INSTALLATION FT. GREELEY, ALASKA | PROJECT NO 1408.003 | DRAWING NO

CONTRACT NO DACA87-94-D-0028

E-3

SHEET 3 OF 3

PLOT DATE: <Plot Date: 01/11/96>